UP IN THE Cloud

Predictive Maintenance Becomes Even Easier With Cloud-Based PdM Technologies

by Christopher Shannon

When researchers at Stanford University, the University of California at Los Angeles (UCLA), the University of California at Santa Barbara, the University of Utah, and Bolt, Beranek and Newman linked together the first five nodes of the Advanced Research Projects Agency Network (ARPANET) in 1970, they never dreamed how important their collective innovation would become.

Since its inception 44 years ago, the Internet has grown drastically and now has even become a tool for maintenance teams. Welcome to predictive maintenance in the cloud.

Taking advantage of continuously developing wireless sensing technologies, cloud hosting makes predictive maintenance even more attractive to industry. Limiting capital outlay, it makes the installation and use of those technologies even easier, giving users the biggest bang for their buck. Not only does it create a remotely accessible centralized system for maintenance teams, it also makes sharing with outside experts simpler and more convenient, while making it easier and more affordable than ever to update software.

"Comparing cloud to non-cloud, you have more interfaces to go through in non-cloud, you have more steps to go through to get data to your respective laptop or computer….so, I guess you could say that cloud has a lot less hassles as far as networking goes," says Mike Hoy, a vibration analyst and maintenance professional at a large university in Pennsylvania.

Predictive maintenance using cloud-based technologies eliminates the worry of integrating with mature corporate networks and the complexity of tying into unfamiliar new software. Cloud setup only involves a small machine that connects to the cloud and talks to the sensors. This reduces installation complexity to plugging a server that talks to the cloud into the wall, which, in turn, allows attention to be correctly focused on the more important maintenance effort of installing sensors on critical machinery.

Cloud systems not only give users their best value, but they limit capital outlay as well, which includes the cost of software and license fees, and the cost of installing and operating software from within a company's own, often highly specialized IT infrastructure. When purchasing software to run on their internal network, many firms insist that the user pay for the software upfront, pay maintenance and support agreements, buy the computer or computers that the software will run on, and pay the system administrators and operational professionals to do everything that is necessary to keep the software running in the customer's own network. That's a lot of responsibility and a lot of expense.

With a cloud-based monitoring system, fees are spread out over time, the cost of maintaining servers is covered and there is no need to buy additional computers or hire additional personnel to manage servers. Service charges for using software in the cloud are less than the cost of ownership and operations of the software if it ran on the customer's own network.

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As far as potential value to your maintenance regimen is concerned, a low-cost, cloud-based system continuously monitors data on asset health. This allows detection of failure signatures at the earliest possible signs of trouble, such as when phenomena linked to degradation first develop, and expensive replacements and profit-robbing unscheduled downtime may still be avoided.

It's more than merely convenient that cloud-based systems can be monitored from a central-

Figure 1: KCF Technologies' David Shannon installs a collection server at a wastewater treatment plant. The collection server is a key element to KCF's SmartDiagnostics® in the Cloud system

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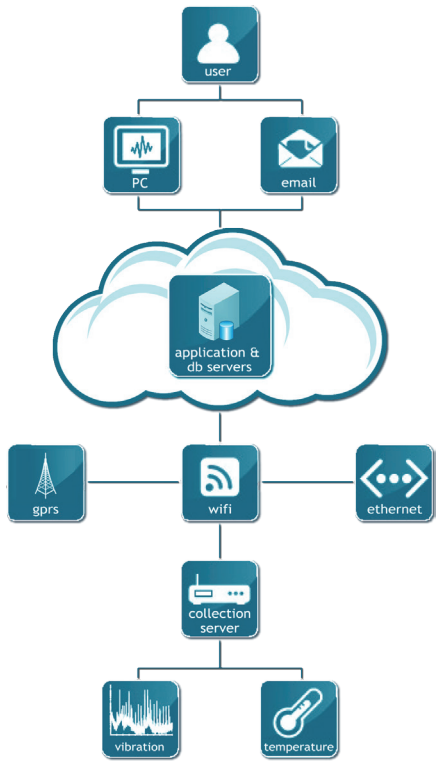
ized location. This also means that organizations with multiple buildings and far-flung facilities, but with small maintenance staffs, have the flexibility to monitor data from multiple machines, in multiple facilities, from one decision-making center. In other words, the cloud allows smaller maintenance staffs to provide more predictive monitoring and to keep an eye on "problem children," critical equipment that may be exhibiting the first symptoms of incipient breakdown. Having a centralized monitoring location also means users can focus resources and optimally schedule skilled professionals who can perform maintenance only when maintenance is clearly needed.

Predictive monitoring in the cloud makes sharing machine health data with outside experts easier. Along with allowing companies to offer a service that differentiates them from their competitors, the cloud also enables them to leverage machine health data on behalf of their clients. From the perspective of customers, this arrangement allows them to only have to hire professionals who specialize in actually maintaining vital machines; they no longer have to hire third-party vibration experts, or similar professional advisors.



The cloud also makes getting software updates easier and cheaper. With software in the cloud, the manager of the cloud system ensures the newest updates will be uploaded to the cloud server. This means users are always getting the latest updates. Because of the cost and complexity of staying up-to-date with new software versions frequently offered by vendors, many companies that install software on their own networks fall behind on updates. When these companies finally bite the bullet and decide to upgrade, mainly because of proliferating problems in the system, the cost of upgrading can become expensive with the costs of modifying databases and training personnel to use the new software. With the cloud, software updates to which customers are entitled happen automatically, little by little, as and when they become available.

To see how the cloud can be an added asset in monitoring industrial machines, look at the different ways that industrial equipment is monitored now, then compare that to monitoring in the cloud.

Figure 2: A sample high-level illustration of one possible cloud system configuration

Figure 3: Using the cloud, this data on the health of a wind turbine in England could be directly monitored here in the United States

Figure 4: KCF Technologies' Matt Cowen attaches a receiver node to a collection server while installing a wireless vibration monitoring system at a paper mill; the collection server will enable vibration data from sensors in the mill to be sent to the Cloud

First, a route-based maintenance strategy where maintenance professionals physically walk around to each asset, place a sensor on the machine and gather data. This method of machine monitoring has many disadvantages that monitoring in the cloud addresses. This route-based scheme only gives maintenance staff brief snapshots of machine health data from which to make recommendations. Also, this method of machine health monitoring has safety issues, as maintenance personnel are required to go into various facilities and climb around sometimes hazardous job sites. Lastly, in some cases, machines need to be taken offline to do testing. Not only can this downtime be costly, but from a practical standpoint, convenient shutdown scheduling is not always easy to arrange.

Second, for continuous monitoring, wired sensors have been a traditional choice. However, wired sensors require not only the installation of the sensors, but also running of cables from the sensor on the machine to a terminal box. This whole process can cost hours of downtime and still requires a good deal of time be spent climbing around job sites. And a wired system is only as strong as its weakest circuit.

Third and most recently, wireless sensing technologies have garnered the attention of manufacturers. Wireless provides a viable solution to the problems posed by the more traditional machine monitoring methods, such as route-based and wired monitoring. However, using a local network can cause headaches when it comes to obtaining access to a company's network. Furthermore, sensor data only can be viewed from a computer that is on that network.

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With the cloud, however, wireless sensing technologies become even more powerful. The issues presented by having to get access to a local network and only being able to view data from a computer on that network are solved when using the cloud because all a maintenance team needs is an Internet connection. Additionally, with data being able to be viewed from the cloud, data can be seen from anywhere, whether it's down the street or across an ocean. As an example, a wind farm in the United Kingdom acquired a wireless vibration monitoring system to monitor some of its wind turbines. Not only could the data showing the health of the turbines be seen off-site in the UK, but it also could be looked at and critically analyzed by the engineering firm in the United States that had sold the system to the wind farm and was helping the farm owners learn to interpret the meaning and significance of the data.

For all the benefits of using cloud technology, some potential customers still have their doubts. Some are nervous about the risk of data or about their machines leaving their enterprise. But the reality is that secure, accurate, complete, real-time data is in the best interest of the cloud service provider. For this reason, the service providers invest in technologies to give clients equal, if not superior, control over their data, compared to what they would have in-house. Furthermore, cloud service providers are committed to maintaining their security and that of their clients' IT infrastructures, because, again, it is in their best interest to do so. In addition, data in the cloud gets backed up and is easily retrieved for integration back into an in-house system, if and when desired.

As the cost of manufacturing continues to rise, the Internet continues to grow and data becomes cheaper. This means that—thanks to a few researchers in the late 1960s and early 1970s—condition monitoring of industrial machinery is becoming easier and cheaper. As part of this growing "Internet of Things," cloud technology is able to utilize the Internet and its ready, high-speed flow of inexpensive data to provide industry with an affordable and convenient option for predictive maintenance programs now and into the future.

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