

**"Information Everywhere" -
Machinery Condition Monitoring in the new millennium**



by Dean Lofall, DLI Engineering

Machinery Predictive Maintenance (PdM) technologies were once considered "high-science". As with most new technologies, PdM has traveled the road from high cost and skepticism to acceptance, market development and improvement. As these technologies have become commonplace in most industrial plants, customers expect greater capability and reduced cost. Today, a wide-range of plant personnel recognize the value of machine condition information. Plant operations, engineering, accounting

and management departments now also value information once available only to plant maintenance personnel. This information is extremely valuable in scheduling repairs, plant operating configuration, planning and future machine purchases.

Today we live in the information age, where we all have high expectations from networked information systems. There are computer networks all around us. We have the Internet in our homes, at our office and now even in mobile devices. You log on to communicate, share files, view a stock ticker, plan a trip, buy a book, or do research. Bill Gates envisions that before too long you will be able to walk up to a display on your refrigerator, and interact with the information services on your home network and on the Internet. The boom of network and Internet technology has drastically changed the way we find and handle information. Barriers are quickly dissolving.

Thus far, the predictive maintenance industry has largely been oblivious this new technology. While each PdM provider's system is designed to acquire, disseminate and present valuable data and information, they do a poor job of providing free access of machinery condition information throughout a plant. Information about plant condition is extremely valuable, but has less value when it is not easily accessed.

In this article, we will be looking at new information technologies that allow information to flow freely, without proprietary software systems or involvement of key individuals. In addition, we will be looking at the trend of computer technology, and as computing becomes smaller, faster, and mobile, and how predictive maintenance can benefit from this boom.

Information not just data

Before we get too far, we need to point out the difference between information and data. When we speak of data, we speak in terms of numbers, spectral plots, waveforms, and band and threshold exceptions. Information on the other hand, is a result of interpreting or analyzing data that describes a machine's condition: Is there a fault? What is the fault? What is the severity? What is the expected time to failure? What are the repair recommendations? Answers to these questions are information. This is what analysts and high level, automated diagnostic systems do best; transform data into information.

Once we have information, then we have the power to make decisions. However, this valuable information is typically locked up at the centralized point of analysis, in the maintenance or predictive technologies departments. While this information benefits maintenance directly, it cannot simply stop here. What about other critical decision makers within the plant, such as operations, engineering and general management? This information should be available at their fingertips, on their control panels and on their desktops.

Part of the problem is that condition monitoring systems from all technology vendors, require that anyone who wants access to machinery condition information, must have their proprietary software installed. This normally is not very desirable, primarily for the following reasons:

- **Cost:** you must purchase extra network licenses to access the condition monitoring system on the plant's network. No predictive technology software system is inexpensive.
- **Software training:** traditional predictive technology software is sophisticated and normally requires training to operate. Especially the integrated systems offered by the large PdM vendors.
- **Predictive technology software** is designed to evaluate data, add analysis, set up test points, schedule tests and print data and reports. Its purpose is not solely to deliver information.

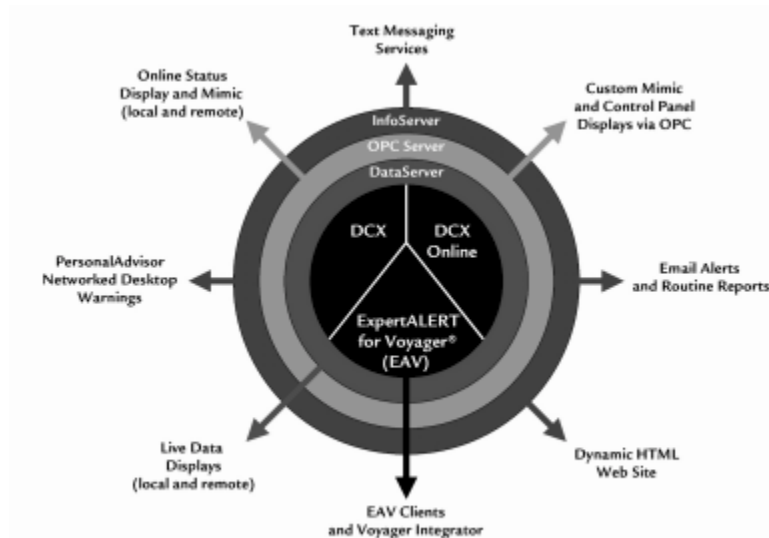
Networking and Internet technologies, distributed computing and OLE for Process Control have made great advancements during the last decade. At DLI Engineering, we feel that it is important to pay close attention to these new technologies. Advancements in network and Internet technology is the wave we need to ride on into the future. Information has become commonplace, and those that cannot deliver it economically will be left behind. We have taken a multi-tiered strategy in delivering information everywhere by utilizing much of the new technology available today:

- **Distributed Computing** – Utilize high powered, mobile computers to move advanced analysis capability and machine history onto the plant floor and remote sites. Mass storage is now inexpensive, so to make the best use of the many gigabytes available in today's computers; complete condition monitoring databases can now be replicated between desktop and mobile devices.
- **Web Content** – Dynamic HTML, Active Server Pages, and Email are all accessible by common tools already installed on your computer. These tools work in the same way on your plant network as they do out on the World Wide Web.

- **Text Messaging** – Machine condition information and machine status changes can be delivered to you by common text messaging services. These services include digital cellular phones and digital pagers. There is no reason that valuable information or important events cannot be delivered to you the instant the system becomes aware of them.
- **Network Warnings** - An Active-X component can be installed on selected networked computers to listen to both the periodic and online condition monitoring systems. If any messages are issued for machines you are interested in, a message box pops up on the screen. This message indicates the type of alert or activity that just occurred on your machine of interest.
- **OLE for Process Control (OPC)** – A new information interface developed by the control system industry and Microsoft that provides a transparent interface of machine data and information to process management systems, plant control systems, plant-wide mimic displays and condition monitoring systems.
- **Microsoft's DCOM** – Distributed Component Object Model. DCOM allows a remote program user interface to control a component on another location of a network. This includes the local area network, wide area network, a dial up connection, or even the Internet.

Information Servers

A key component in distributing information everywhere, are the information servers. In our systems we utilize three servers known as the InfoServer, the DataServer and the OPC Server. Each performs specific tasks, though they are not dependent on each other, they do compliment one another.



InfoServer™

The InfoServer is the workhorse of the system. The InfoServer watches the condition monitoring database, and when a machine condition "event" takes place the InfoServer transmits the new machine condition information to its passive and active clients out on the network. Information that is managed by the InfoServer include machine condition status, fault diagnostic summaries, specific fault severity trends, test status, overall vibration and process variables (such as temperatures, pressure, flow, etc). The InfoServer supports SMTP email, text messaging, Active-X, web content and "PersonalAdvisor" network clients. When linked to the Internet or Intranet, InfoServer will automatically maintain a dynamic machine condition web site on any remote FTP or HTTP server.

DataServer™

DataServer provides data acquisition and distribution services. A computer equipped with a common PCMCIA based data acquisition card can be connected to be used as a remote data acquisition device. Late generation computer technology provides inexpensive but high powered computers, so it becomes practical to employ complete data acquisition and processing systems at the point of collection.

Other client programs and workstations can access the DataServer simultaneously, as it will manage all the data acquisition requests and distribution of the results. For instance, a DataServer can provide continuous data collection to a networked online monitoring system while another workstation is requesting real-time data displays.

OPC Server

OPC Server provides a combination of database and real-time data to any OPC client. OPC also allows for remote control of an automated monitoring system. OPC is OLE (Object Linking and Embedding) for Process Control. OLE is the capability provided by Microsoft's Windows operating system that allows linking of objects such as spreadsheets, pictures, or presentations within other documents or programs. You've all seen a spreadsheet or a chart embedded in a MS-Word document. OLE provides this capability.

Likewise, in terms of a machinery condition monitoring system, information can be distributed to OPC clients. These clients include control panel displays, graphical mimic displays and remote monitoring status displays. Third-party OPC client software is easily configured to include real-time machine condition information on operational status displays. With OPC, you simply select a remote computer or condition monitoring device, (for instance DLI Engineering's DCX Online™ system) and choose the information you want to display on your computer screen.

Find out more about OPC and the OPC Foundation and it's members from the OPC Foundation website (www.opcfoundation.org).

Distributed Computing



Today's advancements in mobile computers and miniature electronics allow the use of a small, fast, Pentium® based, touch-screen mobile computers to host advanced machinery condition monitoring and maintenance management software. This offers the user a highly portable computer to run powerful software systems and SQL database engines that traditionally could only be run on a significant desktop computer. Radio Frequency (RF), Infrared (IR), Universal Serial Bus (USB), direct cable and modem connections allow mobile computers to easily connect to any computer, network or Internet.

Until now a vibration analysis system was made up of a desktop computer, a host software system and one or more portable data collectors. This model has been common since the mid 1980s. Plants, areas and machinery are setup in the host software system. A data collection route (or survey) is created which includes a selection of machines to test. The list of machines and associated test parameters are downloaded from the host PC into the portable data collector, and data is collected. Once the collection is complete, the data is then uploaded from the portable device back into the host PC for processing, analysis and reporting.

DLI Engineering's DCX™ system is a departure from this traditional model. It utilizes a rugged, Windows 98 based mobile computer and 4-channel PCMCIA data acquisition card. This mobile computer employs a complete ExpertALERT vibration analysis software system and a complete copy of a plant's condition monitoring database on its 4-gigabyte hard drive. Because a complete condition monitoring database and software system are on the mobile device, advanced analysis and historical information are available while in the field. Any machine in the plant can be tested at random. In addition, new machinery tests may be added to the database without returning to a host computer to update a data collection "route". The DCX is connected to a network via direct, IR, modem or USB network connections.

An important element of this mobile device is the ability to access a local database, and then share any new or modified data (machinery setup, vibration data, and results) with other individuals. Individuals are defined as any computer, whether an analyst workstation, served database, and mobile or online device that utilizes a common database structure as part of a larger, condition monitoring system. To effectively share data with other individuals within a system of individuals, asynchronous database replication is used.

The database replication used in the mobile device can be simply defined as the process of synchronizing common copies of the data within a network of individuals, whether mobile devices, a common network database, or desktop PC work stations. This functionality is critical to this model, as advanced functions of the mobile device are not possible unless a complete condition monitoring database is present.

Data replication can provide a wide spectrum of benefits, including redundancy of condition monitoring data, fast access to the local database, the ability to utilize a complete database while operating in isolation and assurance that new and modified data will migrate to all locations.

Decentralization of data collection and analysis activities is also very important to today's condition monitoring activities. Machinery condition monitoring specialists are increasingly dispersed in multiple offices or mobile situations that bring them closer to the equipment that requires monitoring. The key problem today is that off-site personnel must access central databases through dialup or wide-area network connections and can typically only use the data collection and analysis systems fully while staying connected. Current solutions cannot deliver performance equal to an on-site workstation database, primarily because these connections are slow.

Web Content



Your web browser and email program are network interfaces of which you are familiar. These programs are installed on new computers or are free downloads available via the Internet. There are a number of ways that these same tools can be used to present machine condition information.

While InfoServer monitors the condition monitoring database, it automatically creates and maintains a dynamic web site that can reside on your network, Intranet or on the Internet. In addition, when InfoServer sees a machine's condition change, it will automatically generate and send an email message to any number of recipients. These messages can be thought of a general information or may be used as an alert mechanism.

In the case of a remote monitoring system, a local computer would be acquiring data, performing automated diagnostics and running an InfoServer. A phone line could be connected to this system providing access to a local ISP. When the system determines that the machine's condition status has changed, the InfoServer will create and send a message that describes the machine's condition and provides a repair recommendation and priority. Additionally, the system can copy the new web pages to a secure location on an Internet server. This allows anyone, anywhere in the world to access detailed information about a machine's condition with their web browsers.

Active-X technology allows a web browser to access real-time information from an InfoServer running on an online data collection system. Just as you interact with a web server with your browser, you can interact with the online system to obtain various data, trends and diagnostic information as well as control the data collection computer. Other Active-X clients include the PersonalAdvisor that sit in the background of your computer. The PersonalAdvisor listens to the InfoServer as it is delivering machinery condition information. When a machine message is issued about one of the PersonalAdvisor's subscribed machines, a message will pop up on your computer screen. With multimedia capability, Microsoft's Agent can be installed on your computer to chime a sound and verbally describe the machine's problem condition. Once the alert is acknowledged, then the PersonalAdvisor goes back to sleep while listening for another message from InfoServer.

Text Messaging

Text messaging is also possible with InfoServer. Sending a message to a digital paging device is no different than sending an email. This capability allows the InfoServer to provide machine condition information to your text messaging device such as a pager or digital cellular phone. For critical equipment, key personnel can be immediately paged if a fault reaches a predetermined level of severity.

Closing

When considering a new predictive maintenance system for your walk-around or on-line needs, you must consider more than the analysis software or the data collectors. Keep in mind that the "product" of such a system is information. This information has great value, not only to the maintenance department, but also to engineering, operations, management and accounting. New information technologies have provided the mechanism to share this information inexpensively. Information that was once locked up in condition monitoring "islands" can now be shared and used by virtually anyone, anywhere in the world. Information Everywhere is a smart strategy to wring every cent of value that you've invested into your condition monitoring program. Connectivity is here now and is expected to drive machinery condition monitoring into the next millennium. Those who don't adopt this strategy will be left in the information dark ages.

Contact DLI Engineering for additional information about all of our products that subscribe to the Information Everywhere strategy at (800) 654-2844 or Email sales@predict-dli.com.

Dean Lofall has been a member of the DLI Engineering team since September 1980. In January of 1997 he became the Product Development and Marketing Manager for DLI Engineering vibration products. His development team is responsible for development and implementation of the Information Everywhere strategy in the release of the new ExpertALERT for Voyager 2.1, ExpertALERT Enterprise, Voyager Integrated PdM Software, DCX Diagnostic Data Collector/Real Time Analyzer and the new DCX Online family of products.

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