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The Computing Enterprise at Your Fingertips



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Industrial operations are taking smart factories to the next level by integrating powerful remote monitoring and management technologies using industrial PCs (IPCs).

Automation system computers are deployed high and low throughout many industrial facilities today. From the smallest packaged equipment systems, to fully integrated production lines, industrially-applied IPCs are a fundamental technology for automating operations.

Many of these IPCs are industrially hardened and very reliable, but if any of them go out of service for any reason it can take significant time to provision a replacement due to their specialized configurations. Any delays are unacceptable for manufacturing companies, where uptime is crucial and every minute of lost production is costly. The same is true for many other industrial operations, such as distribution centers and warehouses.

While the typical information technology (IT) department is well suited to handling normal commercial desktop and laptop PCs in the office environment, they often are not the optimal group for maintaining IPCs critical to operation. This is why manufacturers use operational technology (OT) specialists, either in-house or outside consultants, to perform these duties. But in many cases, these engineering and maintenance OT personnel are not local to all of the facilities they are responsible for, so they must travel to execute repairs or perform maintenance.

Remote management from a centralized location is an enabling technology allowing OT personnel to be more effective in supporting IPCs across many plants or facilities. Remote management platforms allow OT personnel to keep tabs on IPCs distributed among islands of automation within a facility, and even across multiple facilities.

The most obvious benefit for support personnel is the ability to monitor and modify IPCs located anywhere worldwide. This saves travel time and expense, and allows them to respond quickly when a problem is discovered. A subtler, but nevertheless very important benefit, is remote IPCs can proactively notify OT personnel of impending problems, providing advance notice so action can be taken before a failure.

There are many different remote management solutions, but not all are created equal. Commercial-grade versions are commonly used by IT departments, but industrial-grade versions can actually be easier to use, and are more flexible for applying in varied industrial environments.

This white paper will address the benefits of remote management platforms designed for use in industrial environments, and will discuss the capabilities end-users should look for when selecting a solution.

Industry 4.0 Requires Interconnectivity

As computing power rose to prominence during the 20th century, a significant result was the automation of industrial systems and factories. This industrial revolution has become known as “Industry 3.0”. The effort was primarily a localized affair, with individual machines evolving as “islands of automation”. While installations eventually grew quite large, interoperability was always a problem point.

Transitioning to “Industry 4.0” at the beginning of the 21st century still relied on the computing underpinnings of factory automation, but leveraged other developing technologies. Powerful networking capabilities, widespread internet availability, and a proliferation of small but smart devices now enabled much improved communication and data gathering possibilities.

A key element of Industry 4.0 is the use of distributed as opposed to centralized components. Many smart devices exist out at the “edge” of the automation network, and report back to more centralized processors. IPCs typically make up this computing core—but even these computers can be spread out within a facility, a community, or the world.

Extreme interconnectivity across such geographic diversity is an incredible resource, but also represents a management challenge. Industrial companies need efficient ways to monitor and maintain their wide-reaching automation platforms. Fortunately, the same networking technologies enabling interconnectivity can be expanded to remotely manage these assets, making remote management a necessary extension of Industry 4.0.

Practical Benefits of Remote Management

During the early years when PCs were first being deployed into business environments, management of a PC meant an IT technician had to physically go to it in person, look at the display, and type on the keyboard. There was no other option short of calling the PC’s user and trying to talk them through the issue.

Physical presence was a necessary evil for IT departments, so personnel were either stationed at each company location, or were prepared to travel to sites as needed. PCs used in typical office environments already presented support difficulties, and as more PCs were transitioned into industrial roles it was even more likely for IPCs to be physically deployed far and wide in challenging and difficult-to- access environments.

Not only that, but oftentimes the traditional IT department (which would be most familiar with remote management) was assigned only the “business” PCs, while OT personnel were tasked with maintaining industrial PCs. A better method was needed.

As the 21st century approached, mainstream versions of Microsoft Windows included protocols which enabled users to obtain a graphical interface to other remote PCs on the network. Remote desktop capabilities were finally becoming convenient to use for IT departments everywhere. Over subsequent years, the performance of networking

hardware components and protocols improved, as well as the remote management methods themselves.

Companies using IPCs, along with their IT/OT departments, were more than ready to reap the benefits remote management. Table 1 lists several of these benefits, which are described below.

Table 1, Remote Management Benefits

- Enables proactive alerts and actions
- Extensive failure discovery exposes problems early
- Active status reporting allows the fastest possible reaction
- Minimizes downtime
- Allows property managers to know the configurations and key components of remotely distributed assets
- Saves labor and travel costs
- IPC software can be maintained and upgraded as required

Remote management is fundamentally about enabling people to proactively connect with machines by removing physical limitations. From a support standpoint, the technology extends the reach of IT/OT personnel to effectively include the whole world. This substantially simplifies the task of keeping IPC assets in service.

Failures can be discovered early by a centralized support department, allowing technicians to respond quickly, minimizing downtime. And while it is useful to service IPCs which are experiencing trouble, the ability to expose problems before they happen can be even more important for many operations.

When active status reporting points to an impending failure, the IT/OT department can shift functionality to another asset in advance, thereby avoiding an outage or interruption. Solving a problem before it happens is typically very important because eliminating downtime trumps minimizing it.

Another benefit of remote management, beyond enabling repairs, is it can be used to install, upgrade and configure software on remote IPCs. IT/OT personnel in centralized support locations can reach out to all remote IPC assets and make these common adjustments. This is achieved by using the standard remote desktop functionality offered by Windows, or by taking advantage of other keyboard/video/mouse (KVM) capabilities such as Intel's Active Management Technology (iAMT).

Another common use for remote management is to identify the configuration and key components of any number of remotely-distributed assets, allowing personnel to develop inventories of their IPCs and monitor them for changes.

Over and above the technical benefits of supporting hardware, remote management technology effectively addresses some significant human factors. Fewer IT/OT personnel

are able to support far more assets from centralized locations, rarely needing to travel to remote sites. This saves companies unproductive labor and travel costs to a significant extent. On top of these savings, consolidated IT/OT teams are more readily trained, and are in a better position to cross-train and support each other, leading to gains in efficiency.

Every company owes it to themselves to maintain sufficient personnel on staff with a thorough understanding of company processes and systems, yet sometimes this is not possible, especially for specialized areas like remote management. “Working with a lean staff puts many plants at risk” observes this ISA InTech article. “Remote management can fill the gap by delivering boots on the ground quickly as the situation demands it.” (Reference 1)

To fully realize the benefits of remote management in the industrial environment, end users need to choose the right platform.

Unlocking the Power of Remote Management

The industrial environment imposes a number of demands on IPCs. It is often hard to access this equipment, and the hardware is exposed to adverse conditions. Furthermore, IPCs are often in mission-critical roles where downtime means a larger process or operation is halted, thereby exponentially increasing the cost of failure.

Another reality faced by OT personnel is the need to be knowledgeable not just in PCs and networking, but in a wide range of other unique disciplines such as specialized industrial controller configurations and smart instrumentation, as well as niche programming and HMI software packages.

For this reason, any remote management solution employed by OT (and even IT for that matter) is most beneficial if it offers ease of use. There are a number of key features, as listed in Table 2, users should look for in a comprehensive remote management platform. The following paragraphs will explore these features.

Table 2, Remote Management Key Features

- Dashboard and data visualization
- Flexible interface options
- Hierarchical, grouped, and map view navigation
- Detailed hardware monitoring and KVM control
- System backup and recovery
- Notification and reporting
- Server/Agent/Console architecture
- Cloud hosting
- Secure and private communications
- Open RESTful API web services
- IoT MQTT management Suite
- SNMP sub-agent allows IPC to seamlessly integrate SNMP with user’s existing network management software.

Perhaps the most important feature for remote management is a clear and intuitive dashboard interface to provide at-a-glance indication of system status and health, while enabling deeper dives via data visualization (Figure 1). Widgets are one method of enabling users to build their own meaningful dashboards, and quick start templates help them to roll out initial applications quickly. Users demand the resulting dashboard displays be viewable on PCs, tablets and phones running any common operating system.

Having assessed the general situation, users often need to investigate further. Flexible interface options allow access to this detailed information in an intuitive manner. Not all businesses are the same as some have IPCs organized in a strict logical hierarchy, while others associate them into functional groups, and yet others handle their operations from a geographical or map viewpoint. Remote management systems are most usable when they allow users to organize their IPCs to mirror organizational needs.

Once a target IPC is selected, remote management solutions must offer up a multitude of device information. Hardware status data includes device and CPU temperatures, network connection, fan speeds and voltage. From a software standpoint, users need the ability to view process loading, as well as CPU and memory usage. Additionally, it should be possible to manage power on/off schedules. Complete KVM access of remote asset desktops represents a primary means for users to initiate diagnostics and repairs.

Another fundamental feature considered mandatory are comprehensive backup and recovery tools. It is essential these tools be capable of providing manually triggered or automatically scheduled hot backups of live systems. For ease of use, one-click recovery is recommended.

To provide the best utility on a 24/7 basis, the remote management solution must be configurable to identify any kind of events exceeding user selected thresholds. When this happens, the appropriate administrators need to receive automated notifications via text and/or emails, enabling fastest possible response.

Backend Functionality

Front-end features have been the focus of the preceding paragraphs, but the underlying backend functionality is equally important. The most modular architecture employs console-configured servers to centralize all information gathered from agents installed at each IPC to deliver content to user interfaces located anywhere. Figure 2 depicts such an architecture. This content should be served up in a web browser format to offer the ultimate in flexibility. To be fully effective for an enterprise, is essential for any solution to support hundreds of target devices.

Even end users with their own established network management station (NMS) can realize advanced management features of Advantech IPCs, via SNMP sub-agents. Using SNMP over the industrial network, the NMS is able to trap hardware alarms such as high temperatures, voltages, fan speeds, and redundant array of independent disks (RAID) failures and recoveries. Platform information such as operating systems, version

identifiers and boot counts are reported. Other hardware, such as PCI/PCIe devices and USB thumb drives, are interrogated and can be trapped for alarming by the NMS.

Advanced server capabilities allow the system to manage devices across many subnets, and provide redundancy by allowing the data to be synced across multiple locations, maximizing service availability. Furthermore, the servers should be capable of hosting in private or public clouds to give end users the best choice about how to deploy their remote management infrastructure.

Any solution vendor must ensure their products support secure and private communications over the network. Fortunately, as ControlDesign.com notes, the industrial sector does not need to re-invent the wheel, and can leverage commercially available security means and methods. (Reference 2)

Software protocols are the links enabling a remote management solution to be truly open for both devices and third-party systems. One common example is RESTful API Web Service support, which enables functions to be readily integrated across platforms. Deserving special attention is the rising number of internet of Things (IoT) devices becoming available. More than a novelty, IoT devices are becoming mainstream and any contemporary remote management solution needs to interact with them. In fact, MachineDesign.com finds several emerging IoT trends such as: more industrial companies using the technology; new information flows becoming available; and the fact that machines and equipment will be delivered as “IoT-ready”. (Reference 3)

Therefore, the ability to support IoT protocols, such as the lightweight message queuing telemetry transport (MQTT) protocol, is a distinct advantage. From the networking world, implementing simple network management protocol (SNMP) ensures the best interoperability with a wide range of intelligent devices on IP networks.

Advantech’s products offer all these features, providing solutions for “enabling an intelligent planet”. Their WISE-PaaS (product as a service) ecosystem of software building blocks includes many options for cloud, security and IoT services. In particular, the WISE-PaaS/RMM remote management product is foundational to monitoring IPC assets and bridging layers of IoT devices. Various Advantech IPCs and other hardware work natively with this remote management software to offer end users an even better and more comprehensive experience. Furthermore, WISE-PaaS/RMM supports and integrates with iAMT KVM functionality.

Industrial-grade products in this category leverage commercial-off-the-shelf (COTS) hardware and software technologies, but adapt them to the special needs of operating companies. The next sections look at remote management solutions in action.

Industrial Manufacturing Use Case

Industrial manufacturing plants and facilities are a natural fit for implementing remote management technologies to keep their PC automation systems running at peak efficiency (Figure 3). These plants and facilities often contain a mix of control room PCs integrated with large engineered automation systems, as well as IPCs distributed throughout the operation to provide control and/or interface to localized areas or equipment.

Often, automation PC maintenance responsibility falls to OT personnel, although some organizations use IT staff for this purpose, while others implement shared responsibility. In either case, an industrial-optimized remote management solution meets technical needs and is readily usable by all types of staff.

Where possible, it is ideal to specify Advantech IPCs since they are natively compliant with the remote management solution. Other brands of hardware would not offer full functionality, but would still offer a wide range of features. For the initial effort, users would configure the system and establish an inventory in order to begin monitoring all assets. After setup, the monitoring results would be available on demand, but more importantly the system would begin notifying regarding any emerging trouble points.

Maintenance staff would obviously respond to impending problems. In addition, they could perform periodic reviews using the remote monitoring interface to look for any deviations from previous normal operations. This type of remote management technology implementation is essential for keeping industrial manufacturing and distribution sites up and running.

Distribution Center Facility Use Case

Many types of operations other than industrial manufacturing sites can benefit by implementing a remote management solution. Large warehousing operations, such as those used by Amazon and others in their distribution centers, represent an excellent use of this technology (Figure 4). Many companies operate numerous distribution centers all over the country.

These operations typically have sophisticated automation and a multitude of intelligent devices focused on transport equipment, barcode reading and printing devices, in-flight scaling, and packaging and palletizing machines. Smart systems are integrated with warehouse management software (WMS) to orchestrate storage and shipping of product.

While these distribution centers will employ a strong mechanical maintenance staff and also WMS support personnel, it is much less likely for each location to have OT personnel able to maintain the equipment automation systems, especially for unique packaged equipment.

Deploying a remote management solution enables a small centralized staff with specific training to care for widely distributed automation assets, particularly PCs. When possible,

they can remotely initiate changes and upgrades. Or, by using early warnings and notifications, they can proactively direct local personnel to initiate repairs. Remote management is a key way for complex distribution centers to remain online and avoid interruptions.

Conclusion and Outlook

Remote management is a mature technology used to great advantage by business IT personnel for many years. Yet PCs themselves are not deployed just in the front office. Various implementations of PCs can be found throughout all levels of industrial, manufacturing, and utility operations, and even in the systems keeping our workplace buildings comfortable.

But these diverse hardware products, combined with the lean staffing which is a common reality for many companies, means it isn't always possible to have enough trained people within easy reach of these PCs.

This is precisely why remote management is an especially powerful technology for companies to maximize uptime. Not only can a smaller or centralized staff be more effective supporting company-wide PC assets, but these assets are able to report trouble before it occurs, allowing support personnel to be automatically notified.

Of course, industrial-grade operations deserve similarly robust solutions that are easy to master so they are not a chore to administrate, and capable of serving up information to all layers of an organization. This is why the Advantech WISE-PaaS ecosystem, and the RMM "remote management and monitoring" product is so attractive. It economically combines COTS technologies with additional capabilities for meeting industrial demands, and allows end users to quickly expand control of their computing enterprise.

Figures:

Figure 1, Sample Remote Management Dashboard, *Effective dashboards provide critical information at a glance, and also allow users to drill down as needed.*

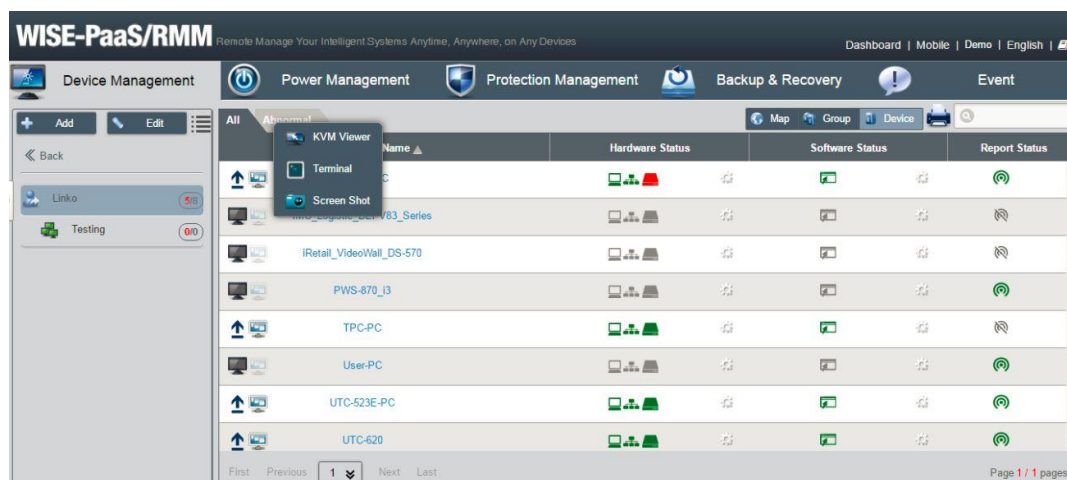


Figure 2, Remote Management Architecture, A comprehensive remote management architecture includes agents at each remote device, a console interface for detailed configuration, and a server interface supporting remote web clients.

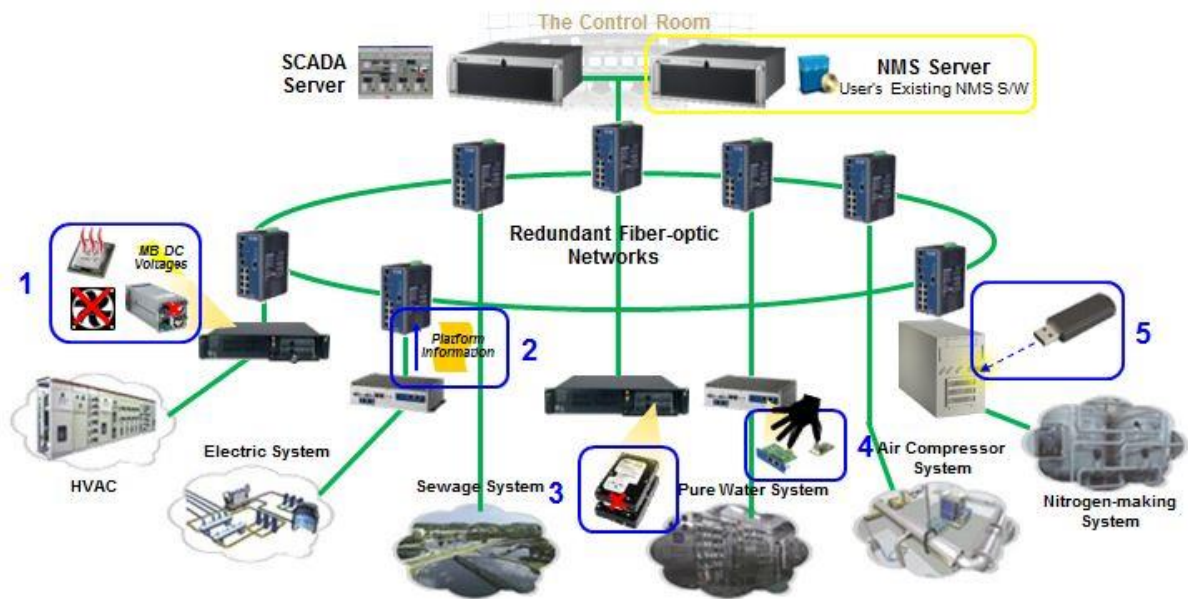


Figure 3, Industrial Manufacturing Application. Remote management is a natural fit for industrial manufacturing facilities, enabling access to hard-to-reach IPCs by IT and/or OT personnel.

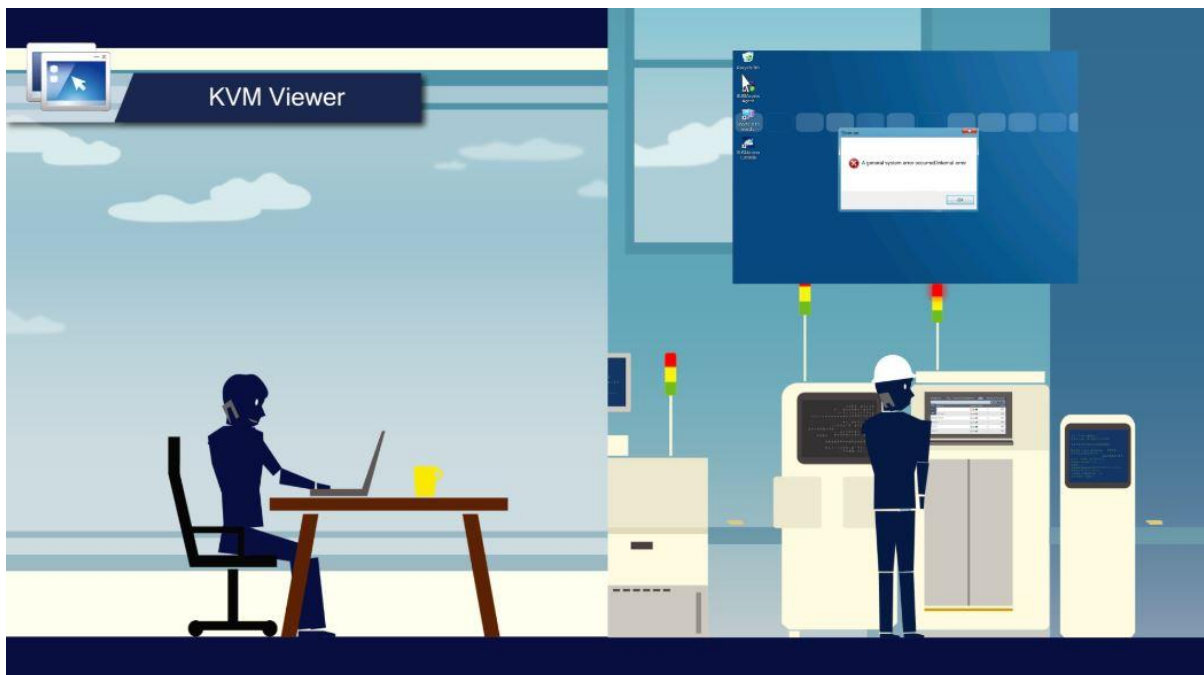


Figure 4, Distribution Center Application. *Many companies operate numerous distribution centers located throughout the country, but can't employ automation specialists at each site. Remote management allows them to leverage centralized staff to keep automated warehouses running smoothly.*



References:

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