Remote Operation of Mining and Sanitation Stations

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Introduction

SCADA (Supervisory Control and Data Acquisition) systems or, simply, supervisory systems were created with the aim of allowing visualization and operation through a human machine interface. Over the years, the supervisory systems have gained new features and characteristics that have allowed for more complex and flexible architectures.

New features include advanced alarm management, client / server architecture and redundancy for more efficient and robust control of the system, as well as remote access via devices that do not even require installation of the supervisory system.

Users have always resisted the use of more open communication architectures, but with the evolution of communication networks and the increase in their reliability, the use of client / server and remote access systems has become part of everyday life in the industrial environment, due to benefits and advantages they provide.

The ability to remotely configure, maintain and control projects brought new possibilities to companies, simplifying and reducing the work of plant operators, in addition to bringing greater dynamism and better response time to the supervision system.

This article deals with the presentation of two cases of success in the use of applications with remote access. The first application presented is that of Sanasa, the company responsible for water supply and sewage services in the municipality of Campinas. The second application refers to Vale's Ferrous Division Southeast (DIFS) system, one of the largest mining companies in the world.

The Technology

In both case studies, GE Digital's iFIX supervision solution, part of the Proficy family, was used in conjunction with Microsoft's remote access solution, Remote Desktop Services (RDS), formerly called Terminal Services (TS), which uses the Remote Desktop Control (RDP) protocol.

The integration of these solutions has evolved a lot, expanding the possibilities of use. Today, for example, remote access to the supervisory system is possible through mobile devices such as cell phones or tablets (Figure 1).

Figure 1 - Access to the supervisory system via smartphone and tablet

The main benefit of technology is the possibility of remote access by several users simultaneously to programs on a server, without the need to have such programs installed on their devices. This access can be given through a local network or even over the Internet. The usage possibilities vary according to the device that will be used as a customer.

Mobile phones, tablets or computers without a Microsoft operating system work through RDP Clients applications. The use is very simple, requiring only the name of the server name or address when opening the client interface.

Equipment using Microsoft operating systems adds the possibility of using an Internet browser as a client, so that access to the server can be done with steps like those used to access a website.

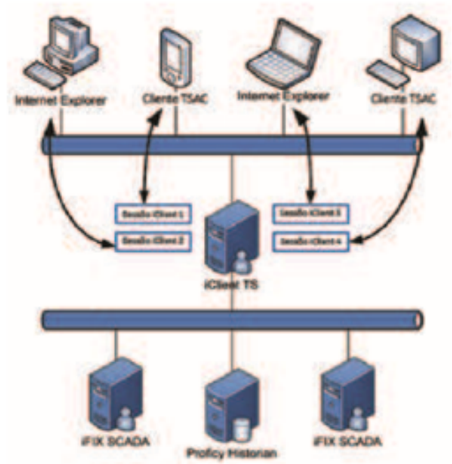

Figure 2 - SCADA architecture with the application of RDS

Microsoft operating systems also bring the possibility of using remote applications through shortcuts that, when triggered, cause the impression of using a local application, although it is being processed in a remote server.

Figure 2 depicts a typical architecture for using RDS technology in the scope of supervision and control (Ref. 2).

In all cases, access can also be made via the Internet or using direct access to the machine, with the integration of other technologies. As an example, it is possible to mention the use of VPN (Virtual Private Network) or access through network redirects with Microsoft Forefront Threat Management Gateway (Forefront TMG), formerly ISA Server (Internet Security and Acceleration) technology.

For greater integration of the supervision system with the needs of each user and type of access, it is also possible to build different types of screens, varying their sizes or characteristics for greater adequacy.

Security and Performance

Remote Desktop Services has different ways to ensure system security. They bring the possibility of using remote applications such as Remote App, where the customer opens only the program that will work and also guarantees the security of opening sections with the blocking of specific users to work only with pre-defined systems and programs. In both possibilities, the user does not have access to the Windows Desktop and, when the application is closed, the section is automatically closed.

A great advantage is the possibility of using centralized security, which allows changes to be made in one place and valid for all users of the system.

The technology also brings the ability to work with multisession, allowing users to share the same applications and access different projects or screens in each active section. It is important to note that all the characteristics of a local supervisory system are reproduced on the remote system, including screens, alarms, scripts or alert sounds.

Another advantage of using RDS is the need for a much smaller network bandwidth. In the case of applications where the network speed is very low, the use of RDS considerably reduces the network consumption used and makes remote access to applications possible.

Below is a comparison of network usage between a common client / server system and a client using Remote Desktop Services. The first graph refers to the consumption in bytes per second of the use of the RDS and the second of the use of a common client, both in the case of remote access to the same supervision screen. It is noted that the

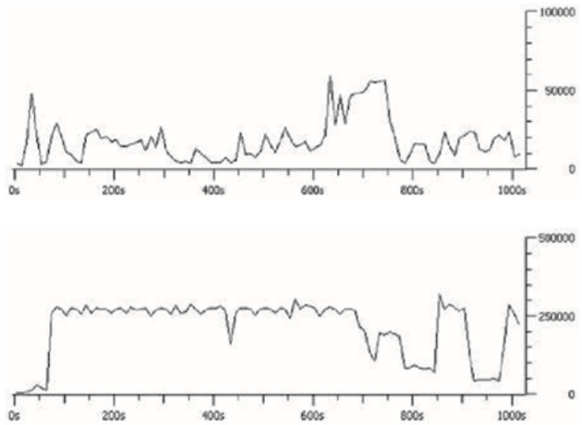

Figure 3 - Consumption of communication band in the access to the supervisory through RDS client (above) and conventional client (below).

average consumption is more than ten times lower in the case of RDS (Figure 3).

It is important to note that the Windows version will directly influence the capabilities of the server used, since there are considerable differences between the versions of the technology.

When comparing between the use of the iFIX supervision system with the common user and the use of the same system with the Remote Desktop Services technology, practically all features of the system can be inherited when using RDS (Ref 2).

RDS provides the capability of multiple instances of Windows and the SCADA system, in turn, full compatibility with this functionality. The system allows different users to have access to the application without the need to have the supervision system installed locally on their access terminals.

The RDP Protocol

The RDP protocol is a multichannel protocol, an extension of the T-120 protocol standard.

It can load presentation data through separate virtual channels, communicating from licensing information to sound, keyboard or mouse update data.

RDP also has multipoint support, which allows you to deliver application data to multiple users in real time, without the need to send data individually for each session.

This protocol has been designed to support several other types of protocols and network topologies in a reliable way, with a low communication band and point to point. It has 64,000 communication channels, but in the case of Microsoft, it uses only one for data presentation and keyboard and mouse updates.

RDP works with the OSI (Open System Interconnection) standard of communication. In (Ref. 3) you can see the communication mode of the RDP protocol: “The data of an application or a service is transmitted through the protocol stacks, being sectioned, directed to a channel (through MCS) , encrypted, automatically broken, framed, packaged in the network protocol and finally addressed and sent to the client. The returned data works in the same way, but in reverse order, the packet is eliminated from its address, broken automatically, decrypted and so on, until the data is presented to the application for use. Important parts of the protocol stack modifications occur between the fourth and seventh layers, in which data is encrypted, automatically broken, framed, directed to a channel and prioritized.”

Mining Application Case Study: Vale

In this item, an application from Vale, belonging to the Ferrous Southeast Directorate (DIFS), will be addressed.

The reported information explains the reasons for implementing the RDS Client tool in the largest mining company in Brazil and explains how this technology facilitated the use of the supervision system, from operators to system administrators.

Vale Case: Remote Access for Operation and Engineering

Using client / server architecture and the application of RDS Client technology, it was possible to implement in Conceição, one of Vale's main mines at DIFS, remote access to the supervision and control system.

After this implementation, both the PLC programming station (Programmable Logic Controllers) and the SE697103 substation, which has the largest number of plant equipment, have access to the supervisory system, even though they are physically distant from the control center.

Access to the system in the PLC programming room is necessary due to the development and testing of programming logic that needs to be carried out (Figure 4).

Figure 4 - Remote access via RDS Client in the PLC programming room and in field operation interfaces.

The use of the system at the substation interface aims to relieve the operator's load from the control room on preventive plant shutdown days.

In Conceição, the equipment interlock diagnostics are in the supervisory; this makes it easier and faster for field operators (electricians and mechanics) to take the appropriate actions for each diagnosis directly, without the need to use a telephone or radio and contact the operator of the control room (Figure 4). This allows for faster and more direct actions.

It is very important to simplify the supervision routine, as the operator is responsible for many other tasks in addition to plant operation, such as coding downtime, interfacing with the field, preparing reports, among others.

Another important aspect of implementing remote access is security. That is why it is very important to correctly set permission for each type of system user and to consider certain premises, such as the fact that the main command is always from the control room.

In the substation, for example, access is read-only, the command remains in the control room. What does not happen with the PLC programming room, since commanding is one of the main tasks of logic development.

Another characteristic that motivated the use of technology was the ease of maintenance that comes from its use, since maintenance is done only on a physical server. It is as if remote access stations did not exist for system administrators.

The supervisory system is installed and configured on the server machine, which must be licensed for a certain number of competing remote accesses. In the access terminals, however, neither installation nor system license is necessary.

This feature contributes to the reduction of hardware, which is one of the main problems for the maintainers of any system. The concern ends up being much less with respect to parts replacement, driver compatibility, management (governance), etc.

Other sites also use RDS technology, such as Brucutu and Cauê.

Vale Case: Use of Mobile Interfaces

The flexibility of architecture provided using RDS technology means that we can also provide access to the supervisory system through mobile devices, such as the iPad and iPhone, for example.

Screen display tests were performed using an iPad (Figure 5), which only required the installation of a free application to allow access to screens of the supervision system. The results obtained were satisfactory. The next step in using this feature will be the mapping of system users.

Figure 5 - Use of RDS on mobile devices, such as the iPad.

Sanitation Application Case Study: Sanasa

All Sanasa process automation applications today use only GE Digital's iFIX software (Ref. 5) as a SCADA system. As a result, the RDS Client remote access tool was implemented. The purpose of using the technology was to make it possible to integrate several SCADA systems into a single visualization and control platform, which can be accessed through Windows' remote desktop feature.

Before the implementation of the Remote Desktop Session Host (Server), now used to control the entire process, two other technologies were used. One was characterized using ordinary customers, each with its own screens and its own licensing. It was a simple configuration and with great availability from customers, but with difficult maintenance of the system, considering the large number of client machines, which caused difficulties in managing licenses and changes in the application. The second way was to use a tool for converting screens to HTML, a solution that required a lot of work to correct the distortions that occurred in the operation screens, which required many hours of engineering.

Another advantage found in the use of RDS was the ease of installation and exchange of machines, since in the old operation solution (common customer) there was a need to install the supervision software on each machine, whereas in the current situation, the installation is only on the server. Taking the number of existing customers, which today total 17, the tool brought a great advantage to the company.

Sanasa Case: Remote Operation

The remote access tool via RDS provides a real-time visualization of the process variables and allows the realization of a remote control with the process control elements, maintaining the reliability and security of the system.

The tool is used in Sanasa's CCOs (Operational Control Centers) in the raw water collection, water treatment, reservoir and treated water distribution sectors. In addition, this tool is also used in the sewage removal system, with the forecast to be used in sewage treatment units in the future.

Access is available to a wide variety of users, including management personnel and other work groups, such as the project sector group, which uses the tool to verify and analyze real-time data and historical data for the elaboration of new projects, which will be integrated into the existing system.

Through access to this information, it is possible to streamline the process of field survey and validation to fulfill the prerequisites of a new project.

In the case of system maintenance, it is also very useful to be able to access the SCADA system from any point in the Sanasa network, enabling changes to screens, databases and other system settings. The Sanasa network can be accessed locally or remotely (where access is made through a broadband ethernet radio link system).

Figure 6 presents examples of operation screens that are accessed through remote interfaces via RDS Client.

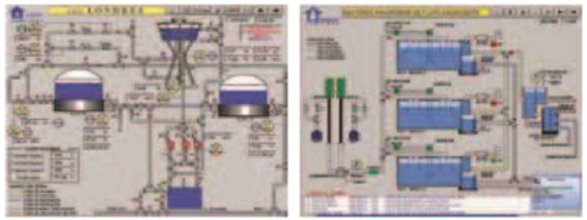

Figure 6 - Example of remote access for operation and remote control.

Sanasa Case: View and Demonstration

Sanasa's automation system is extremely important for the operation of the water collection, treatment, reservoir and distribution system in the metropolitan region of Campinas. In this way, we can consider it as a system that requires high availability and that operates twenty-four hours a day, seven days a week. As a result, remote access to the supervision and control system (SCADA) is often required. This remote access is carried out via VPN between Sanasa and the remote connection point (for example: home), using a broadband link, or even a connection from a mobile vendor.

The RDS Client system has also been used in some events, to demonstrate the automation system and data acquisition system. At the ASSEMAE sanitation fair, a CCO was simulated in the middle of the booth (Figure 7), where the operating personnel of the water reservation and distribution system performed the monitoring and control of the Sanasa process in the event, through the definition of the set control and alarm points, remote activation of control elements, such as pump sets, valves, etc.

Figure 7 - Remote access for demonstration at the fair

Conclusion

It can be concluded that the technology presented in this article makes the routine of the administrator of the supervision system very comfortable, since he/she only has one machine to manage. The immediate result is less time for system and application maintenance and control. In addition, there is also a reduction in equipment costs for the company, which only needs a good machine to be the application server.

As described in (Ref. 1), when a program is deployed on a terminal server and not on each device, some advantages can be observed:

- Windows-based programs can be deployed quickly to computing devices across the enterprise. Remote Desktop Services is particularly useful when you have programs that are frequently updated, rarely used or difficult to manage.
- The amount of network bandwidth needed to access remote applications is significantly reduced.
- Remote Desktop Services helps users' productivity. Users can access programs that run on a terminal server on devices such as home computers, kiosks, low-power hardware and non-Windows operating systems.
- Remote Desktop Services provides better program performance for users in offices who need access to centralized data stores. Programs that process a lot of data sometimes do not have client / server protocols optimized for low-speed connections. Such programs generally perform better on a Remote Desktop Services connection than on a typical wide area network.

This type of technology facilitates maintenance in harsh environments that can cause some damage to the equipment. After some damage to the equipment is found, there is no usual need to reinstall software and prepare a new computer. You can simply exchange the device for a new one and it will already be working and ready for use, resulting in faster, easier and cheaper maintenance.

The main gains obtained by Vale using RDS technology with the iFIX SCADA system were:

- Time savings and greater efficiency in decision making, since the operator was able to view the entire plant without having to contact the room.
- Greater safety due to the elimination of possible noise (errors) from communication failure, which could cause accidents. This is an important gain, considering that security is an inviolable value for Vale.
- It has been proven that the use of the RDS is of great value for the supervision of the plant, both for operation and maintenance.

At Sanasa, the use of the RDS Client platform with iFIX provided gains in TCO (Total Cost of Ownership or Total Investment Cost) because it is a license with a more affordable cost compared to the value of the same number of conventional customers.

In addition, there is a greater flexibility of setting the access level for each user of the system, which can be visualized, operated or even administered by the system, enabling application engineering.

Another advantage observed is that the server can be allocated in a data processing center, where it can share some other operational advantages, such as: use of automatic backup routines, better availability of the network, greater availability of bandwidth, power and adequate air conditioning, resulting in a gain in the useful life of the equipment and, consequently, an increase in the availability of the system.

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