

# Cloud, Simple Practical Applications – *On industrial automation, process control and distributed real-time systems*

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## KEYWORDS

Supervisory Control and Data Acquisition, SCADA, Human Machine Interface, HMI, Distributed Control Systems, DCS, cloud engineering, cloud-ipad era, Software as a Service, SaaS, distributed processes, industrial automation, ipad scada, Real-time software technology

## ABSTRACT

There have been many good discussions on the applicability of cloud-based solutions for manufacturing and process control systems. On one side, some people have concerns regarding security and control of the information, on the other side, there are identified benefits enabled by cloud systems. From VMS minicomputers to DOS and Windows, from ArcNet to Ethernet, it is inevitable the industrial automation systems shall adopt the technologies that are getting predominant in IT general use; the current environment that I am calling the “Cloud-iPad era” is no different; therefore the practical discussion is not if those new technologies will be applied in the industrial environment, but how. This paper is not intended to join the conceptual discussion about the cloud, but just to present a few simple practical examples, where cloud technologies are already enhancing industrial automation solutions and enabling new business opportunities.

## INTRODUCTION

In the context of this article, the expression “cloud application” designates any application in industrial automation, process control or managing real-time distributed (data) information, where the Internet technologies play a major role in the solution.

Those applications share some common concepts: data is exchanged outside the company firewall, shared internet infra-structure is used and the assets or resources used by the solution are distributed. Not necessarily will the applications scenarios we will review shall rely to use servers from external companies “located on the cloud”, even an internal enterprise application that enabled links to the internet cloud technologies is, for this context, a cloud application.

Typically “cloud application” triggers one to think about an application being hosted by a remote third-party server location, or publishing data on the internet, but those are only some of the potential

scenarios for cloud technologies. The application cases we will review use internet technologies in a few different ways: collaboration on engineering and project development, they use the shared internet infra-structure as the transport layer for internal corporate applications; to publish real-time data to consumers outside the company firewall, real-time access to external consulting or expertise resources and the management of distributed or movable assets.

## **COLLABORATIVE ENGINEERING ON THE CLOUD**

When applying cloud-based solutions, there are two distinct basic steps: the first step is used during the application development and deployment phase using cloud collaboration tools, what we refer to as Engineering on the Cloud. The second step, involves running the application, the project execution or runtime, where remote users gain real-time access to production and process information, which we refer as Real-time Data publishing.

When discussing industrial automation projects, for some reason, almost everyone assumes it is the second scenario: the access to monitoring and real time data systems. However, an easy and powerful benefit of the new technologies starts before even running the project, during the development and configuration phase. This major benefit, which is not being explored and employed enough, is to use the cloud to enhance the collaboration capabilities for engineers developing the project before it goes to production; especially for remote collaboration.

The cloud enables collaborative project configuration, where multiple engineers can access the centralized database either using VPN or an internet cloud-server, in order to create the project configuration including the user interfaces, application development, data connection definitions and the other metadata that later will be executed when running the project (run-time mode). Besides allowing the collaboration, the system implements change management, keeping track of the project revisions.

This feature is applicable even when the ultimate final project may run on premises only, with no external access, as it greatly enhances the productivity of the project development and deployment.

When creating custom source code, there are already many solutions such as SVN, which allows a distributed team of engineers to work on the same project. But most tools and software packages used on HMI, SCADA, Business Process Management and Manufacturing Execution Systems do not allow the Software as a Service (SaaS) model and they were created with very little, if any, concurrent distributed access during the configuration phase.

When you have a team of engineers working, for instance on a large SCADA configuration, the traditional way the engineers interact with the end users and external consultants, is typically in face-to-face meetings or sending print-screens and ftp-downloading the whole project configuration from one place to another one; the cloud solution enables this interaction in a much more efficient way.

When you compare that old method with a centralized configuration with no collaboration tools with the distributed-based mode, where everyone is sharing the workspace in real-time either on a VPN or

on a cloud server, the benefits of the cloud technologies are abundantly clear; it is akin to evolving from having only local email servers to allowing web access to your emails. During this decade we will see the extinction of software tools which do not allow distributed cloud collaboration for the project configuration.

## **REAL-TIME DATA PUBLISHING**

The other aspect of the Cloud and SaaS model is the execution of the application on a Cloud Server. This allows remote users to get real-time access to production and process information.

In this scenario, the project server can be hosted by the user or be provided by a third party. The server will be receiving the data published from multiple on-premises applications and data-acquisition systems which are installed and running locally on the processes.

As the server runs as a web service, where the initiative to publish or request data is from the remote sites, it is possible to implement the highest standards of network and internet security on the connections. The server is able to push the information to multiple clients, such as Web clients, Rich Clients and smart devices such as iPhones and iPads.

The difference between these new systems and the traditional ASP servers is the built-in real-time capability where, even without a refresh request from the client side, the user interface is continuously updated based on the real-time data collection and the communication happening in background.

## **OEMs AND MACHINE BUILDERS, VERSION MANAGEMENT**

Continuing with the examples of cloud engineering, OEMs and Machine Builder can achieve great cost reductions, easier maintenance and enhance the quality of services with the cloud engineering paradigm.

When doing a project configuration or maintenance, if you are using the software configuration tools as a service, the OEM or machine builder does not have to spend time and money managing many versions of the configuration tools. They can simply access all versions directly from the provider. The software company providing the Software as a Service (SaaS) will handle the management of the project and product versions, keeping track of the versions used to perform maintenance on the projects.

The SaaS model and cloud technologies can also be used to distribute project versions to the installed base and get automated information of potential maintenance problems on systems deployed in any part of the world.

As an example, a few years ago, when the cloud applications were not yet mature, I had contact with a project for utilities monitoring, where each retail store, around one thousand locations, had its own local control and software solution, publishing the data to a centralized location and allowing a remote

web view of the store. Even that system back then was using some cloud concepts, such as publishing the real-time utilities data to a server, it was not yet leveraging the full cloud benefits, as the software and project maintenance were not using cloud solutions, requiring a visit to the store, or a one-to-one download from the server to each remote location. This kind of project, where you need the ability to keep track and eventually update a widely distributed set of similar applications had a disruptive, but positive, evolution thanks to the cloud technologies; that same project executed with current tools would have been executed in a fraction of the time and cost.

## **INTELLECTUAL EXPERTISE AND OPTIMIZATION SERVICES**

In the past, a company with a high level of expertise in specific processes could only provide services doing the one-to-one consulting; typically putting an expert onsite. Some examples of expertise services are: optimization of furnace operations, monitoring of KPIs and OEE, loop tuning, alarm and notifications optimization and reducing, Real Time Performance Monitoring and performance of similar plants, and predictive maintenance via analysis of historical data.

Currently, when the local factory automation is created using the latest software tools, with built-in cloud integration, the system can automatically push information to the cloud server, where a mix of automated tools and the manual inspection of an expert, in a central location, can deliver real-time feedback to the multiple plants.

This kind of real-time consulting, which can be either hired on a regular subscription basis or on-demand for critical situations, is creating some new business models not based on the software or an automated service, but on the direct and shared access to a process expert/specialist.

## **AUTOMATED DATA ANALYSIS SERVICES**

One step further of the previous scenario, it is when the process of the data analysis is automated. In many markets, such as providers of Furnaces, Turbines, power plants, and more, they can collect historical information from their customers to provide data analysis services. The new cloud technologies now allow these services to be implemented in a much more efficient way.

The equipment manufacturer can setup a Cloud server visible to the on-site applications, where automated software tools will exchange information getting the data necessary to run the analyses. For large amounts of data, the system can easily define some server side processing, so only the results will be sent to analysis. The feedback of that analysis can be published back to the users and consumed by the monitoring application directly.

One application case of this solution is the monitoring for predictive maintenance on offshore equipment or other systems that have operations with no local monitoring, or even there is a local monitoring, the data analysis required shall be executed elsewhere, either because of the computing resources, intellectual property protection, or for safety and disaster recovery requirements.

## **INTRINSICALLY DISTRIBUTED APPLICATIONS**

The systems monitoring telecommunication infra-structure, geographically distributed assets, such as vehicles or portable generators, agricultural weather and irrigation monitoring, and other processes, by its own nature, don't have centralized data production or consumption, like what you would have in local factory processes. Those applications are "born for the cloud". Prior to the adoption of cloud technologies, the costs and management effort for such applications were so high that in some cases the application was not executed at all or strongly reduced in scope.

Just as in IT departments, a mix of on-premises and cloud tools working collaboratively is emerging today for industrial automation systems. In industrial automation, there is always a physical device in place, so the local applications will always be important; it would be impossible to have a pure cloud control application as at a minimum the sensor should be at the premises, but the applications will be created using cloud collaboration tools during the development and, when running the production, it is likely to have some real-time information being exchanged on a cloud infra-structure.

The application cases in this category include the data consolidation of wind-farms operations, monitoring distributed energy assets connected to a smart-grid, cell towers monitoring, tracking moveable assets such as backup generators, as well the real-time integration of producers and their supply-chain.

## **IPAD, IPHONE AND SMART CLIENTS**

The use of iPads, and smart devices on all kinds of business operations, including automation systems is an ongoing growing trend. Such devices, by their own nature, are most of the time likely to be used outside the company firewall. The current cloud technologies enable the easy creation of Internet gateway servers, which collect or receive the real-time data from many on-premises applications and make that information available to the iPad and other smart devices users, acting as a data gateway.

Whether the integration is in one direction, just to monitor KPIs or status information, or it is bi-directional, allowing remote commands is a project decision; there are many scenarios where also allowing the use of external commands is beneficial. Regarding potential security issues, the users are currently using these devices to manage their banking operations therefore it is certainly possible to setup safe secure applications in the industrial environment.

Some existing application are essentially like web pages running on the new devices, but the major evolutionary step are with the new generations of tools, created using the native iOS or Android features, with the functionality tailored to maximize the iPad platform. Those new apps are creating a faster and more secure environment to deal with real-time data and sensitive information, changing operational procedures and the information workflow. The same as the PC, Ethernet, Windows after being adopted by consumers found its way to the corporate and automation business, it is inevitable that the iPad native applications will get it's space and place in the automation arena; especially as a mobile solution.

## CONCLUSION

A typical discussion on cloud SCADA is about replacing the local server to a remote server on the cloud, keeping only the data collection on the site; but this is one type of application the most polemic in the trade-offs of removing components from local site operation to an external service. But, the point of this paper is not the discussion of that one scenario, but to show and enumerate many other useful scenarios, where the cloud technologies are already being applied with very positive and productive results.

## REFERENCES

- [1] Gartner Group, "Gartner Identifies Top 10 Strategic Technologies for 2012"  
<http://www.businesswire.com/news/home/2011018006616/en/Gartner-Identifies-Top-10-Strategic-Technologies-2012>
- [2] Taccolini, Marcos, "Gartner Top 10 Technologies for 2012 and Industrial Automation Software"  
<http://tatsoft.com/blog/?p=97>
- [3] Peter Williams and Simon Cox. "Engineering in the Cloud: An Engineering Software + Services Architecture Forged in Turbulent Times", The Architecture Journal, June 2009
- [4] Speak, Graham, "Industrial World Slow to Accept Cloud Computing", Jan, 5, 2011,  
[http://www.industryweek.com/articles/industrial\\_world\\_slow\\_to\\_accept\\_cloud\\_computing\\_23581.aspx](http://www.industryweek.com/articles/industrial_world_slow_to_accept_cloud_computing_23581.aspx)
- [5] Damisch, Alexander, "Industrial Automation and the Cloud", Apr, 2012,  
<http://blogs.windriver.com/industrial/2012/04/industrial-automation-and-the-cloud.html>