WHITE PAPER

Six Tips on How to Lower the Total Cost of Ownership of Industrial IoT Networks

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Introduction

The Industrial Internet of Things (IIoT) trend is facilitating a growth in connected devices on networks as well as increasing the scope and complexity of industrial control networks that frequently converge with traditional IT networks. More now than ever before, concerns about security, availability, and performance are having an impact on these industrial control networks. One consequence of the IIoT trend is that simply purchasing devices for your network isn't the end of your expenditure. In fact, it is often only the beginning. Network operators are discovering a host of associated direct and indirect costs that can often exceed the initial investment in networking hardware.

This whitepaper considers some of the costs that are often overlooked, and suggests some best practices and tips on how to lower the total cost of ownership (TCO) for industrial control networks. After purchasing a switch, a variety of factors need to be considered throughout the product life cycle, including installation, configuration, operations, maintenance, downtime, and ongoing technical support. After taking all of these factors into consideration, network administrators are in a much better position to be able to judge the true TCO of a project and make the right decisions to ensure that the TCO is kept as low as possible.

The Challenges for Increasingly Complex Networks

The time from the start of a project until it is up-and-running can be broken down into broadly six different stages. The challenge for network administrators is to have a deep understanding of each stage of the project and determine the key features that a device should include or support that are beneficial for that particular stage as well as to what extent these features will be beneficial in the future when the needs of the network change. These features and benefits often don't appear in the hardware specifications of a product, but are essential to keep in mind when purchasing products. For example, the vendors who provide switches for a project can allow those who are deploying and setting up the network to make their quotation more competitive if the deployment and setting up can be completed faster. This will also allow those who are installing and configuring the network to have more time for other projects. The six stages are discussed below, with scenarios provided to give a fuller understanding of the different factors affecting the TCO.

Released on August 30, 2016

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Looking at the Total Cost of Ownership

After considering some of the challenges of networks, it becomes evident how the costs associated with commissioning and operating a network can easily exceed the cost of the networking components. Some of the general steps involved in commissioning, operating, and supporting an industrial network will now be considered in order to gain a better understanding of the TCO.

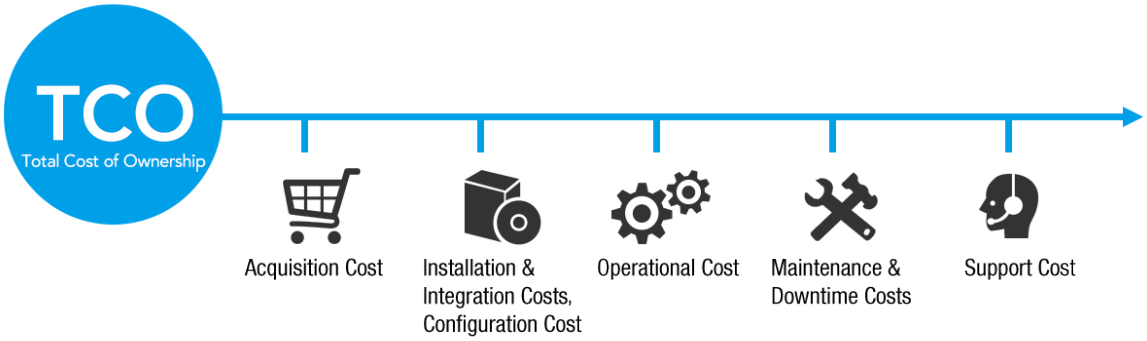

Figure 1: Costs incurred within the project life cycle.

Reduce Installation and Integration Costs

It is rare to see completely new network installations in industrial environments. The majority of network deployments involve a combination of new equipment and upgrades using existing SCADA systems, control networks, and devices. It should be noted that as no two networks are the same, each network has its own set of unique requirements. One of the skills that a network administrator must have is the ability to choose and deploy the right devices to ensure that the current and future requirements of the network are met. A good example of this is ensuring interoperability across all devices on the network throughout the project life cycle. Although there are numerous ways to overcome certain problems that may arise throughout the project life cycle, one of the best solutions is to choose products that offer the most flexibility.

For industrial networks, devices are often installed in control panels with other devices that run on different voltages, so one solution is to purchase a power converter to ensure compatibility. However, this may not be the ideal solution for all network administrators due to size constraints of the panel where the devices are being installed or the additional costs incurred from purchasing power converters. For some projects, the cost of deploying new cables can add significantly to the overall costs of the project. A better alternative is to use a device that supports a wide range of power inputs that will satisfy the present demands of the network, and provide added flexibility for devices that must also be added to the network at a later date. Although the initial expenditure may be slightly higher for a switch that supports these features, it becomes clear how costs can be reduced over the duration of a project by avoiding additional costs at a later date.

Reduce Configuration Costs

One of the most time-consuming tasks for projects in industrial environments, and therefore one of the most expensive, is configuring devices on a network so that they have security

settings, redundancy, interoperability, and efficient performance. A wide range of options are available, from very basic switches that offer no support with configuration, all the way up to large software packages that cost considerable amounts of money on a per-annum basis but greatly assist network administrators with the configuration process. As the number of devices on a network increases, so do the possibilities for savings. Below are some of the main areas that have been identified pertaining to the configuration stage of a project, all of which have a strong effect on the TCO.

- Due to the convergence of industrial automation and IT systems across IIoT networks, EtherNet/IP and PROFINET protocols must have a way to operate together on the same network. Devices that have been preconfigured to allow for these disparate protocols to communicate automatically allow network administrators to deploy what is essentially a plug-n-play device. These devices will also often support automatic discovery and the ability to assign IP addresses automatically, allowing a significant portion of the time required for configuring these devices to be eliminated. Compare this with using cheaper devices, which will require a lot more effort to be spent configuring the devices later on in the project.

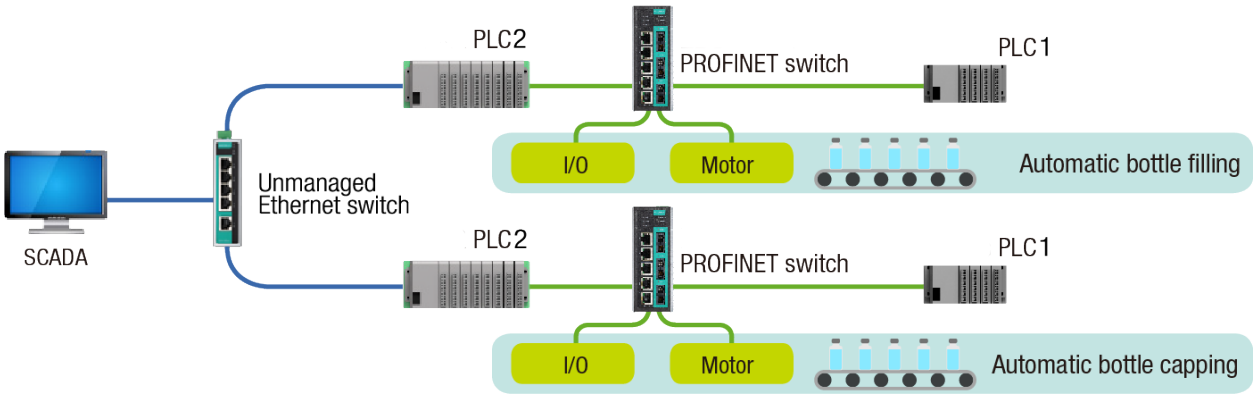

Figure 2: The multi-protocol capability makes it easier to integrate PLCs with the SCADA system.

- Configuration costs are not limited to when the network is being set up for the first time. Any feature that allows copying and saving device configurations will provide network administrators with the ability to reuse these settings at a later date, and eliminate the need to manually configure new devices that are added to the network.

- Configuration is also made a lot easier by an intuitive graphical user interface (GUI). Some companies will offer an advanced testing kit, which allows users to test the GUI and independently validate the claim that it is intuitive before installing devices on a network. An intuitive GUI can save network operators a significant amount of time for the duration of a project.

Figure 3: Batch configuration is one of the most effective ways to reduce configuration costs. Since the number of networked devices keeps increasing, both time and money can be saved by using mass configuration, instead of configuring individual devices one by one.

Reduce Operational Costs

A key way to lower operational costs is a design that requires the minimal amount of manual work to keep the switches and network operational. In addition, ensuring product suitability for deployment in industrial environments will also help achieve optimal operational performance.

The two main reasons why devices on industrial networks malfunction is their moving parts and the power inputs, which are often referred to as points of weakness. Switches that have an absolute minimum of moving parts are much less likely to malfunction or break, resulting in less network downtime and therefore reduced expenditure. Similarly, if the device supports dual-power inputs and one of the power supplies fails, the other power supply will keep the device running, allowing the faulty power supply to be replaced without network downtime. For deployments lasting longer than 10 years, which is the norm for IIoT networks, there is a very high chance that network administrators will encounter one of these problems at some point during those 10 years.

Reduce Maintenance Costs

The majority of IIoT networks are controlled by programmable logic controllers (PLCs). When the network performs scheduled maintenance and performs a reboot, a PLC will often take around 20 seconds to reboot. If a PLC boots up before the network is ready to operate, errors will occur that can cause further delays. Switches that can boot up in about 10 seconds as opposed to 100 seconds will be ready to operate as soon as the PLC has rebooted, thereby avoiding the aforementioned problems.

Being able to view the current status of the network at a quick glance via software or an app is one of the easiest ways to monitor a network. These apps and software sometimes incorporate an alert system that warns network administrators that an event is taking place that has the potential to cause a failure on the network unless the problem is rectified. Alerting the system administrator that a problem could happen later on, as opposed to a system that merely informs the administrator that there is a problem now, is an excellent way of reducing

maintenance costs. These features may increase the purchase price of the switch but over the course of the project life cycle are likely to result in substantial savings.

Reduce Costs Associated with Downtime

Finding the root cause of downtime on a large-scale network is very time consuming, so any tools that assist network administrators with identifying the point of failure and allow them to quickly fix it will have significant advantages. Another skill of successful network administrators is to be able to calculate whether the additional costs of features that can help reduce downtime are likely to outweigh the costs of any downtime experienced.

- Devices that can be remotely accessed and configured are very beneficial because they allow untrained personnel to perform the time-consuming task of going to the field site, while the trained specialist can perform troubleshooting and configuration remotely from the control center. In addition, a device that offers playback support allows the specialist to identify what occurred at the time the switch went down, and help improve the design of the network to avoid this kind of failure in the future.

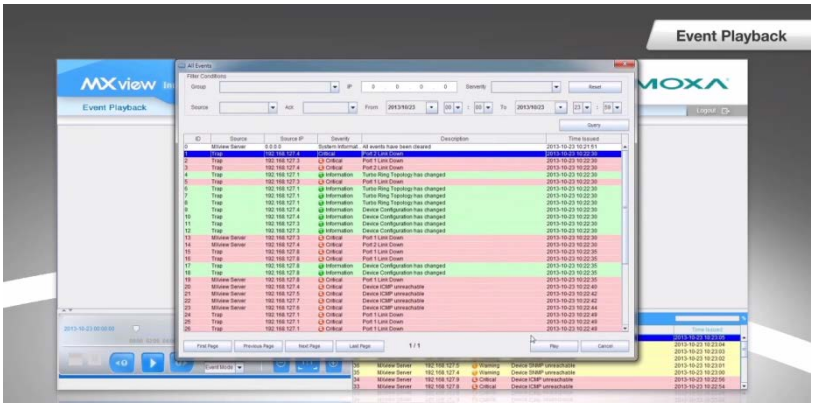

Figure 4: A tool that can play back events to help quickly narrow down the possible cause of the network problem.

- Devices that back up the switch's configurations on a dongle are particularly helpful if the switch malfunctions. To automatically import all of the settings, all you need to do is plug the dongle back into the switch. As no configurations need to be performed manually, the amount of network downtime is reduced.

- As network administrators are not always based in the control room, mobile apps that support event notifications provide network administrators with the ability to respond more quickly to events taking place on the network, allowing them to get the network back to normal more quickly than would have otherwise been possible.

- Self-healing redundancy technologies ensure that networks stay up-and-running even in the event of a single node failure. Deploying redundancy technologies that allow greater flexibility, availability, and scalability for future network expansion can help avoid additional expenditure in the future.

Ongoing Technical Support

When purchasing a switch, a wide range of options are available, from cheap devices that offer no ongoing support, firmware upgrades, etc., to switches where over the course of the project the ongoing technical support will cost significantly more than the switch. As switches are often deployed on networks for longer than ten years, the technical support that comes with a switch will significantly impact costs in long-term deployments. For example, new security threats are regularly identified and companies that offer ongoing technical support will often release a security update via a firmware upgrade to eliminate new cyber threats. Conversely, when a device on a network is compromised and ongoing technical support or firmware upgrades are not available, the network administrator will have to replace the device or risk the security of the whole network. Reliable switches that offer free ongoing technical support complemented by a long warranty period present significant advantages for network administrators who want the lowest TCO for their projects.

Conclusion

After considering the life cycle of a project and the hidden costs that can be incurred throughout this life cycle, it is clear that multiple factors must be considered when determining the direct and indirect costs of an entire system. It should be noted that network administrators can never be 100% sure what the future needs of an IIoT network are, but having a full understanding of the six stages described above ensures that network administrators are more knowledgeable about which devices have the best chances of lowering the TCO throughout the duration of a project.

Please visit Moxa's website for more information on how to lower the TCO:
http://www.moxa.com/Event/IEI/Lower_TCO/index.htm