Aged Infrastructure – Part 1: Identify, Plan, and Prioritize

The past few Tech Tips that I have written focused on passwords, user accounts, PLC code, and overall general access to your critical infrastructure SCADA assets. This month, we are going to start a few part series on Aged Infrastructure. Just as important as managing access to the applications on your SCADA network is ensuring the devices that make up your SCADA network are still active products and manufacturers are still supporting these devices. The purpose of this series is to address the often-forgotten components of your systems and how important it is to have a plan when one of these devices becomes outdated.

In the next few paragraphs, I will explain how to best identify, prioritize, and plan for the replacement of aging components of your water and wastewater systems. For the purposes of this article, we will focus on the tech of your control systems; the control devices (PLCs), variable frequency drives, networking equipment, PCs, servers, UPS, and software.

Identification

The first step in managing aged infrastructure is to, first, identify what critical components of your system need attention.

Below are brief explanations of each device we will focus on:

- **Control Devices** – These devices are typically found in control panels and can be responsible for quite a bit, depending on the underlying programming inside of them and the type of device. The device's main function, typically, is controlling the processes of your operation. Control devices do this by making pre-programmed decisions, based on various field conditions that it monitors through instrumentation such as a pressure sensor. Some examples of control devices are PLCs, level controllers, or generic loop controllers.
- **Variable Frequency Drives (VFDs)** – VFDs control various motors which in turn can be driving many different process equipment. Typically, VFDs are controlling pumps or blowers based on process conditions. Though these devices can be considered a field device, most modern VFDs have some sort of programming in order to operate and can be connected to SCADA networks via a digital fieldbus, such as EthernetIP or MODBUS.
- **UPS** – Uninterruptable Power Supplies (UPS) are key to both power conditioning as well as power backup. UPS are typically found in control panels, plantwide centralized units, or skid-mounted near important equipment. Like all things, these require maintenance, mainly ensuring the batteries are within spec and making sure to replace batteries when necessary.
- **PCs –** Typically in the form of desktops and laptops, these are the primary means of accessing the SCADA HMI, historical data, security feeds, administrative tools, and possibly reporting software.

- **Servers –** These are the computers that serve, as the name implies, the various applications to your PCs for use by operators, management, maintenance staff, and administrative staff.
- **Networking Equipment** – This is anything that connects your control devices to the PCs and servers that run your control software. These can be switches, routers, gateways, radios, or cellular modems.

Now that we know what to look for, start making an inventory of the various items within your systems if you have not already done so. Some good information to account for in your inventory is the age of the equipment, model numbers, serial numbers, version numbers, number of devices in service, and number of spare devices on premise. All of this information will allow us to perform our next step; prioritization.

Prioritization

In a perfect world, everything on the inventory list that was old and outdated would be replaced at once. Unfortunately, the reality is that budgets and time are involved in the decision-making process and doing everything at once may not be feasible. Instead, water and wastewater utilities need to prioritize and one way to accomplish prioritization is through evaluating the following:

1. **Lifecycle status of equipment –** The first item that should increase the priority to "critical" on a device is the lifecycle status of the equipment. Check with vendors and manufacturers to determine if parts are still being made for your devices as well as if there are any migration paths to new products. If devices are obsolete or end of life, this will make replacement difficult.

2. **How many spares are on hand/what are the equipment lead-times? –** Having spare parts on hand can get your systems up and running quickly if something fails. If you do not have the spare part on hand, knowing how long it would take to get a replacement may sway your decision on which parts to stock in order to speed up repairs when replacements are necessary.

3. **Cost comparison between old and new**
    - Old, unsupported devices are typically going to be more expensive to buy a direct replacement than a device that is actively supported by the manufacturer. In addition, unsupported devices may require you to go to third-party marketplaces, such as eBay, to source your spare part which has its own implications. Buying used parts for a public entity is not considered acceptable, depending on your local legislature, let alone that it does not guarantee that the spare part will work when installed.
    - New, supported hardware migrations are ideal though often are not "flip of a switch" type projects. These require planning as well as possible re-engineering, depending on what is being replaced. This is often overlooked when considering replacement paths for old hardware. Do not expect your old to new migrations to be quick but do expect them to save you overtime, maintenance, and downtime!
    - When considering the migration or replacement of old hardware, also consider the "hidden costs" of the old device. Consider the amount of overtime that has to be spent each time an operator is called out to fix an issue with old hardware, the emergency costs from the vendors to support your system in the middle of the night, and the

production loss of your system. These are by far the most overlooked costs when determining if an old device should be replaced.

4. **Effect on Operations** – Similar to the "hidden costs," what happens if a piece of equipment fails? How many more operators will be needed to manually control a process in the event the control device fails?

Planning

Once all of the information from your system has been gathered and each device has a prioritization for its migration or replacement, PLAN! Either internal meetings between public works staff, external meetings with engineers, or both, your best success is when you plan migrations! Do not wait until it becomes an emergency!

Whether you are new to the public works field or have been here for the long haul, consider what state your system is in now and who will be responsible for your system after you retire. We want to make our best effort to ensure our system is running smoothly and that we are prepared if something fails. If you are passing down your car to your kids, would you give your kids a car that had brakes that no longer stop the car as designed or didn't have a spare tire? I hope not.

We all have the incredible blessing to be civil servants. With that, comes responsibility and it is all of our duty, whether in public works, an engineering firm who consults on public works projects, a system integrator who is implementing these systems, or a vendor who offers solutions, to be good stewards of our community's water/wastewater systems. Together, let's tackle our aged infrastructure and proactively plan for maintenance and replacement.

Nicholas A Paradiso, PE
Lead Automation Engineer
Concentric Integration