

# Labtainer PLC Lab Manual

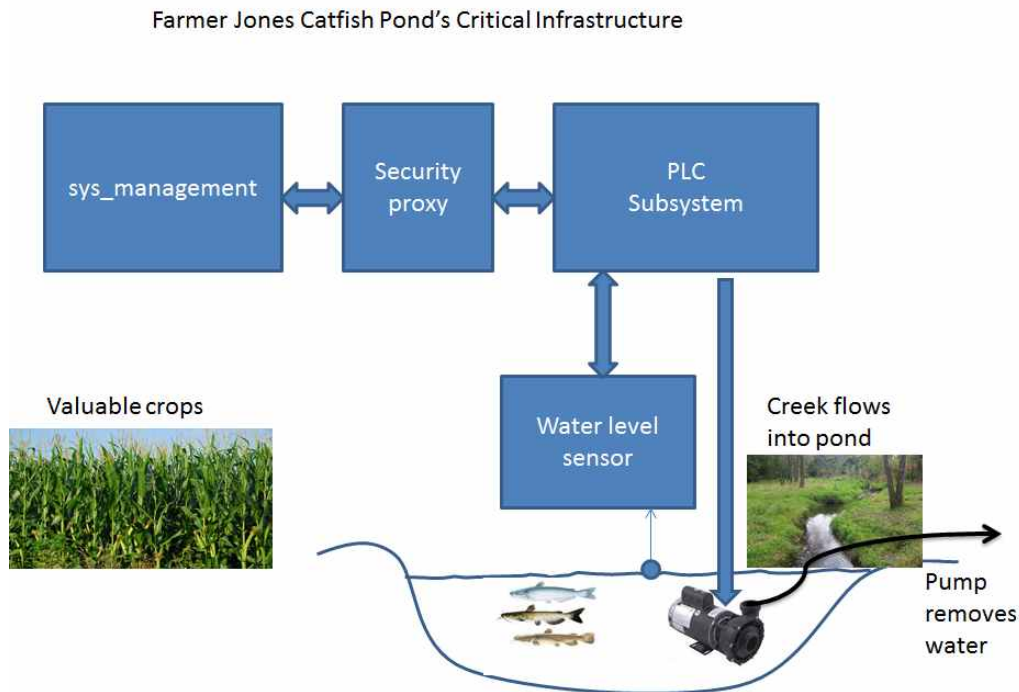
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## 1 Background

This lab explores a few security issues related to the use of Programmable Logic Controllers (PLCs) in the management of Industrial Control Systems (ICS), or similar forms of infrastructure.

This lab manual is very brief. You should read this "Background" section before starting the lab. The student is expected to be somewhat proficient in the Python programming language, and is expected to have performed the "onewayhash" lab.

This PLC lab simulates the system illustrated in Figure 1. A PLC manages the water level of a creek-fed catfish pond, ensuring the water level does not exceed minimum and maximum limits.



You will interact with the **sys\_management** system to load a program and configuration data into the PLC. You will also use the **sys\_management** system to check the status of the PLC and to query which program and configuration data the PLC is running. You will not have direct access to the PLC subsystem, though you can interact with it via the **sys\_management** computer.

A "Security Proxy" sits between the **sys\_management** computer and the PLC. The vendor promised that this will prevent attacks on the PLC. You can draw your own conclusions about that claim. You will interact with the Security Proxy in an attempt to make it useful. But first, start the lab as noted below (if you have not already done so).

## 2 Performing the lab

The lab is started from the Labtainer working directory on your Docker-enabled host, e.g., a Linux VM. From there, issue the command:

```
./start.py plc
```

The resulting virtual terminals will include:

- A display of the status of the fish pond level.
- A virtual terminal connected to the sys\_management computer.
- A virtual terminal connected to the Security Proxy.

When the lab starts, observe the status window. The PLC is initially disabled, and thus the pump does not run and the water rises. You can initialize the PLC from the sys\_management window using:

```
./manage_plc.py load plc config.txt
```

The "plc" parameter is the name of the plc program file in your home directory. The "config.txt" is a configuration file in your home directory. This operation will initialize the PLC, leading to the pump to run.

The configuration file directs the PLC to keep the pond level between 20 and 30 feet. Just watch what happens over the course of about a minute.

After you've watched the status window for a full cycle of disaster, poke around a bit.

Hints:

- Use "./stop.py plc" and "./start.py plc" from your Linux host to stop and restart the lab – this is the best way to reset the PLC if it becomes corrupt. Any files saved on the components will be preserved.
- The manage\_plc.py tool lets you retrieve the code/data from the PLC. Are those the files you loaded?
- The sys\_management computer includes the openssl utility that you used in the onewayhash lab, might that help determine if the files are the same?
- Could the Security Proxy be modified to avoid sending bad files to the PLC?

### 3 Tasks

Alter the proxy.py program on the Security Proxy computer to prevent exploitation of the PLC. You are not expected to make changes to the sys\_management system, though you are free to explore it. However, credit will only be given if changes to the proxy.py mitigate the attack.