Swift VISA Wrapper

1. Company Background

Dr. Owen Hildreth is an Assistant Professor in the Department of Mechanical Engineering at the Colorado School of Mines. His primary research is on nanometer to centimeter-scale additive manufacturing technologies. He has written numerous MacOS applications for custom data-collection and visualization as part of his research.

2. Project Description

We are looking to make a Swift wrapper for the National Instruments VISA hardware communication protocol. VISA and PyVISA are widely used to automate instruments and integrating various manufacturers equipment into one product. For example, in his 3D nanoinkjet printer, he uses it to control his Newport movement stages and my Agilent electronics. Dr. Hildreth currently use the Python VISA wrapper, PyVISA, so that he can write easy-to-implement Python instead of harder-to-implement C (which is what VISA is written in).

While Python is nice, it doesn't have the OS support that other languages have – so things like Notification Centers, UI handling, Multi-threading, etc. become more laborious. He is interested in a team of undergraduate students to write a Swift VISA wrapper so that he and other engineers/scientists/companies can use Apple's Swift programing language and all of Apple's API's directly in our research. Swift's syntax similarities to Python should help the transition from PyVISA to a SwiftVISA implementation.

This project is an excellent opportunity for a student to directly contribute to an open-source project with broad, real-world applications. It will expose students to writing dll's, controlling hardware, and object-oriented programming. Students will be able to use this as a concrete demonstration of their skills when applying to future jobs or internships.

2.1 Deliverables

1. Final design report (mandatory for all teams)
2. Working prototype SwiftVISA wrapper capable controlling power supplies (set voltage, read voltage, read current)

2.2 Proposed Process

Since the students probably won't have experience with controlling instruments, the project will follow a simple progression to get the students familiar with the VISA communication protocol, using the existing PyVISA wrapper, Swift's protocols for serial communication, and wrapping VISA commands using Swift. The goal at each stage is to: set a power supply's voltage, read a voltage, read a current, and calculate the resistance across a resistor.

1. Use Agilent's custom GUI to control a power supply
    a. goals: become familiar with connecting to an instrument, identify the necessary text commands used in NI-VISA, and debugging instrument state
2. Write a small, command-line utility in PyVISA to control a power supply
    a. goals: become familiar with connection to an instrument through PyVISA, implementing the Agilent commands through PyVISA, and setting/reading instrument state
3. Write a small, command-line utility in C to control a power supply
    a. goals: become familiar with the C storage elements underlying NI-VISA's communication protocol
4. Write a small, command-line utility wrapping the above C-code in a Swift function
    a. goals: identify the correct Swift storage elements that map the underlying NI-VISA C-code unto Swift-compatible storage elements for serial communication
5. Start translating the PyVISA's structure to a SwiftVISA wrapper

2.3 Summary

Develop the communication protocol that will be used on next-generation scientific and manufacturing equipment.

3. Desired Skill Set

Curious, self-motivated, interested in making an impact that will define how research equipment and machines a controlled for the next decade

4. Preferred Team Size

3-4 students

5. Internship Opportunity

Lab research opportunities continuing to support the SwiftVISA wrapper

6. Location for Work

Off-site and on-site at Colorado School of Mines.