

## Introduction

The goal of the project was to design a compute and storage module that resides in a WatchGuard security appliance and connects through a PCIe backplane.

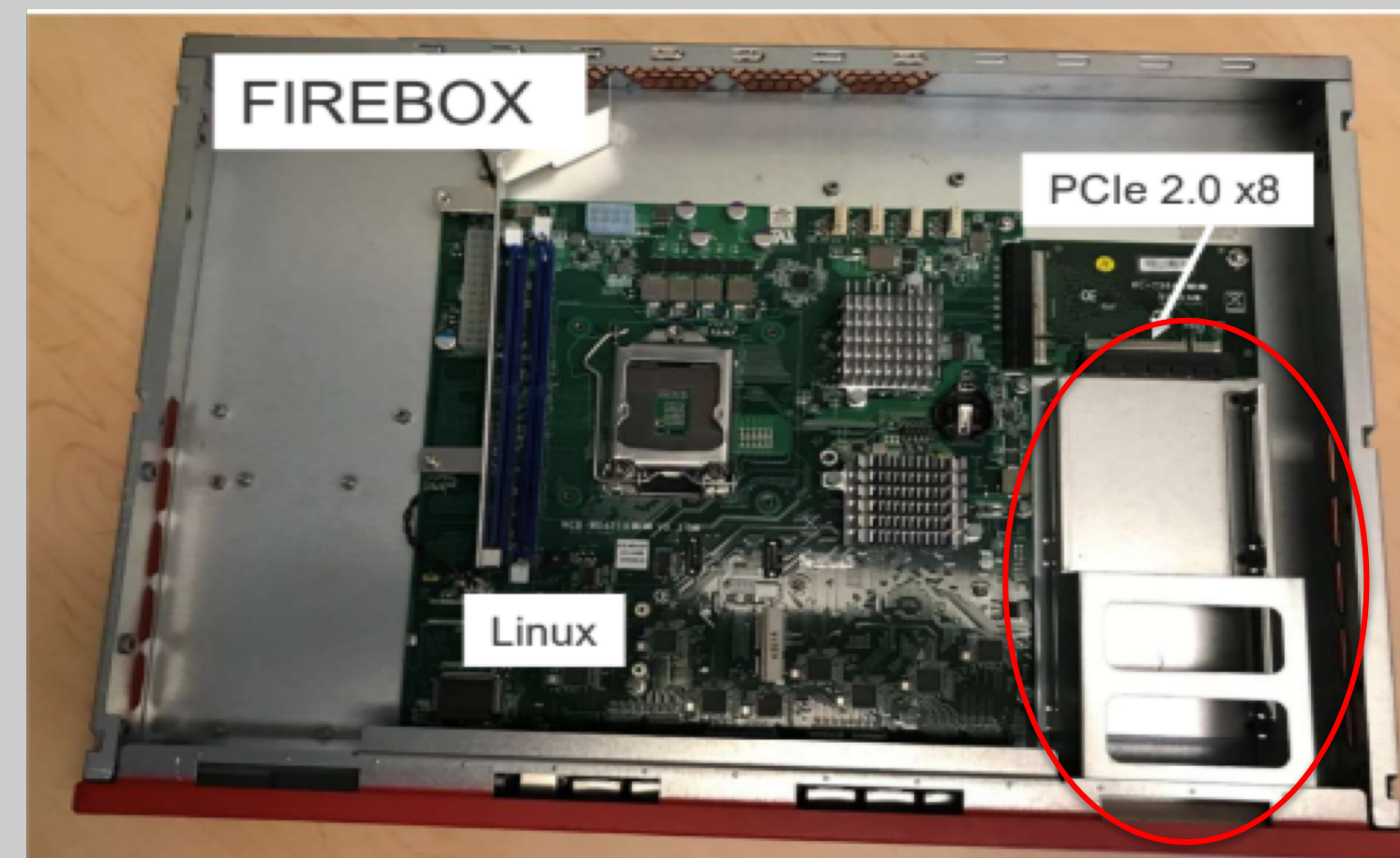


Figure 1. Firebox appliance with connection for compute module

The existing Firebox hardware would send incoming network data to the compute module. The module will then analyze the traffic and present the results to the user.

## System Diagram

The compute module has a processor capable of running Linux, along with a set of software libraries to process data received from the security appliance.

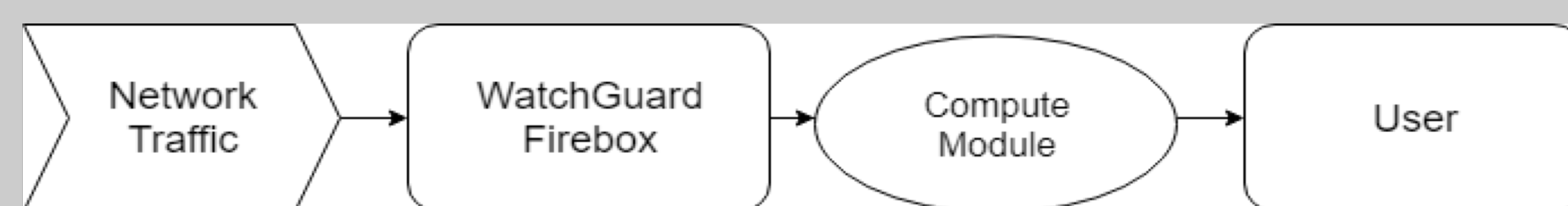


Figure 2. Datapath for compute module

module

Network traffic enters through the Firebox and then gets sent to the compute module, which will then store and analyze the data and present the results to the user.

## Technical Approach

- Obtain a reference design that we could base off.
- Use the reference design to create a block diagram that was customized to our specification.
- Modify the reference design to create a wiring schematic according to the block diagram.
- Create a layout of the PCB design along with the bill of materials.
- Write hardware code for logic controller inside the compute module.

## System Specifications

- Dimensions: 3.3 x 7.5 x 18.9 cm
- Processor: NXP LS2088A (ARM)
- 8GB DDR4 DRAM
- 1TB M.2 SSD for storage
- 8GB NOR flash for booting
- Power delivery through PCIe x8
- Separate 12VDC power connector for stand-alone bring-up
- Consumes a maximum of 75W of power
- Communicates to the main board only through PCIe

## Block Diagram

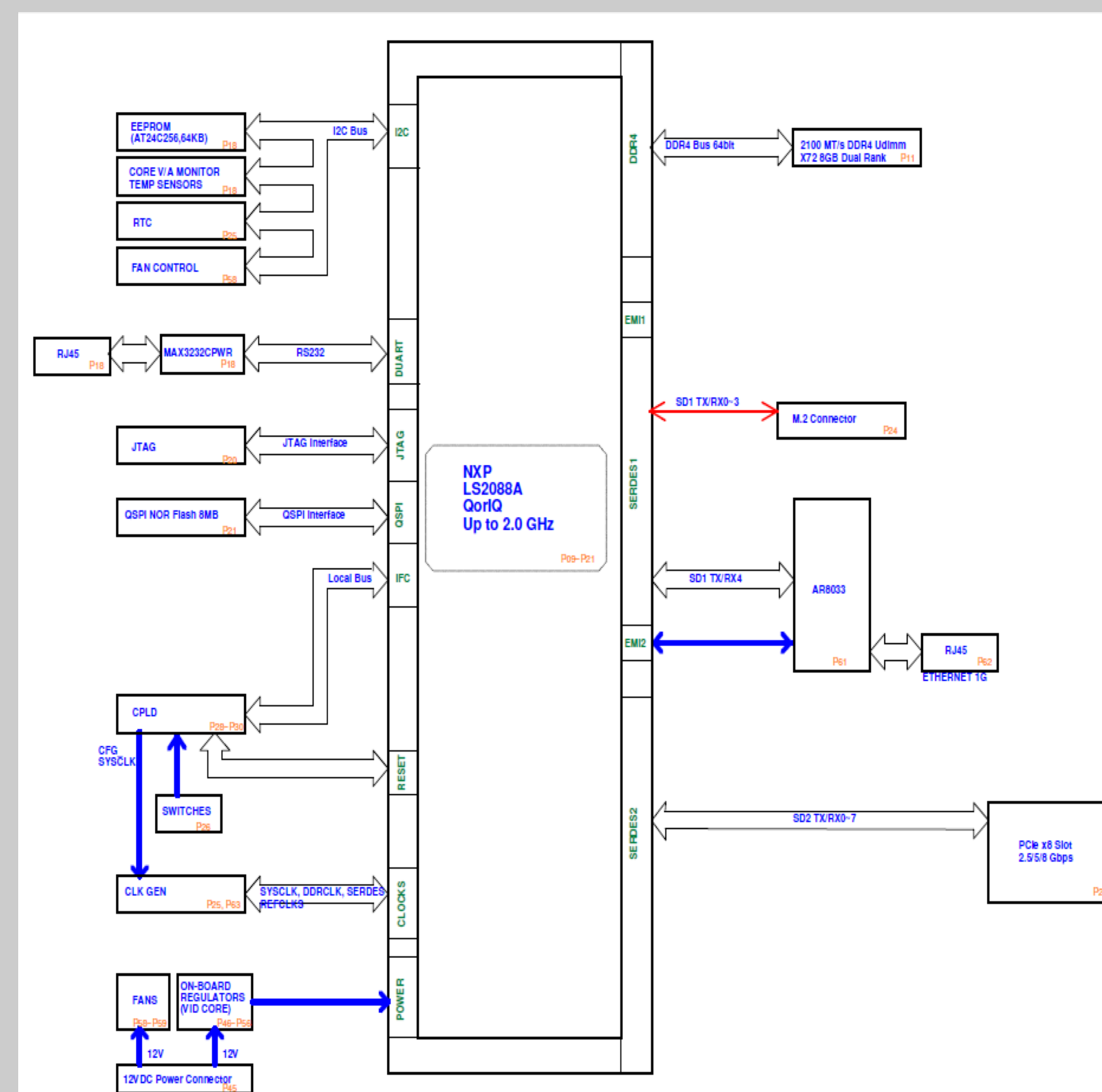


Figure 3. System block diagram

## Module 3D Layout

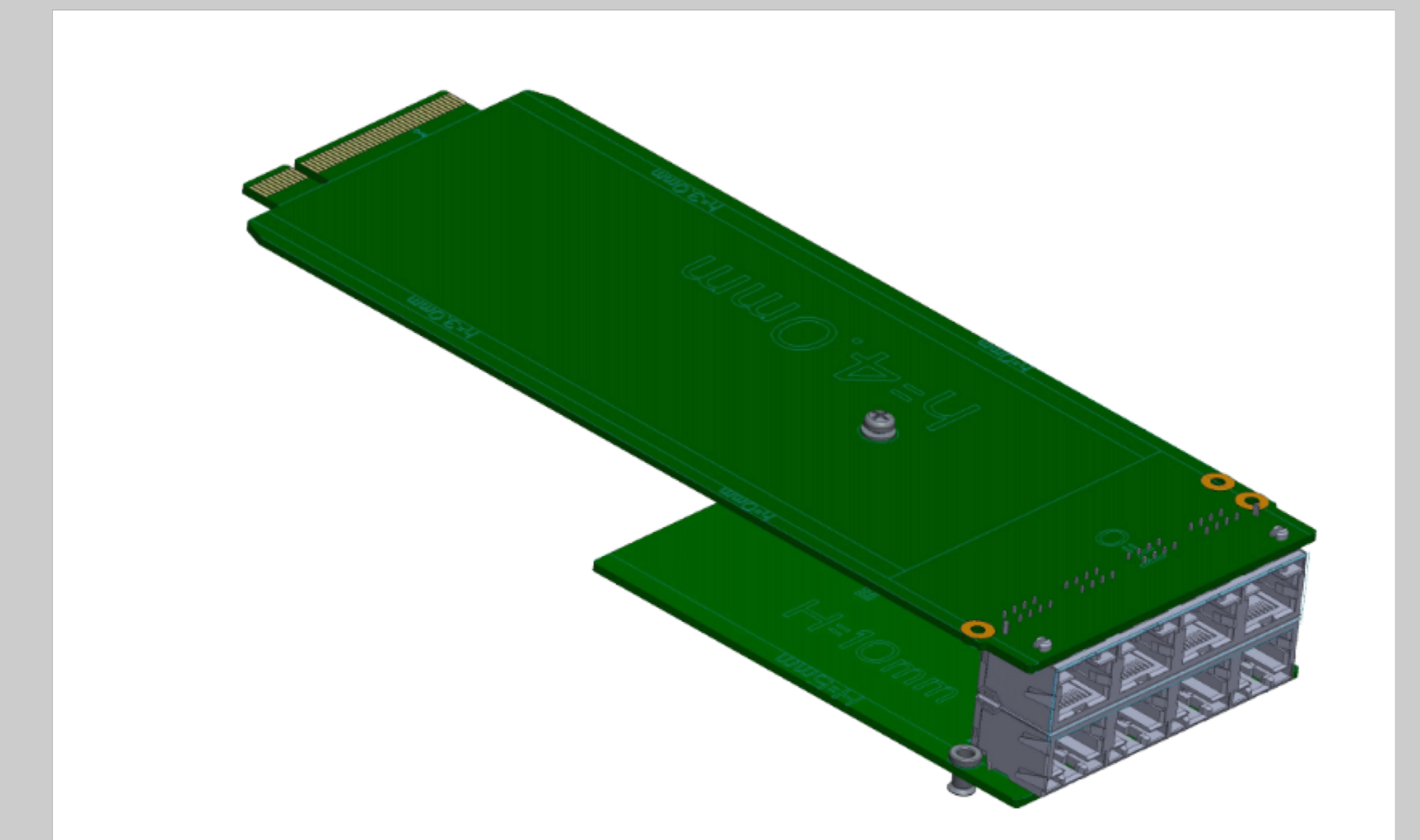


Figure 4. Form factor for our compute module

## Results

- Completed a design that is ready for production.
- Our design minimizes space used by eliminating unnecessary components.
- The CPLD in our reference design is reprogrammed to function with our new design.
- The compute module is able to be run in a WatchGuard Firebox chassis or on a testbench, allowing more robust testing procedures.

## Future Work

- Manufacture the module based on the layout and schematic wirings.
- Boot a Linux operating system onto the board's processor.
- Write a PCIe driver so that the board interfaces with the main security appliance.
- Install the desired software to be used for network data analysis.

## Acknowledgements

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