IPConfigure Hardware Assembly Internship Reflection

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Introduction

My time at IPConfigure has been exceptionally beneficial to my professional career as I have gained countless skills both in terms of technical ability and working in a formal office setting. I chose IPConfigure as the organization for my internship for several reasons. First and foremost, I had several connections at this organization before applying for the hardware assembler position. Secondly, my previous experience in IT support positions meant that I would enter this position with a basic understanding of what steps are necessary to assemble a server. Finally, the proximity to campus made this position ideal as travel time was minimal. When beginning this internship, I hoped to gain a deeper understanding of the process involved in assembling servers to an industry standard, learn more about operating systems, particularly Linux, which a vast majority of our servers utilize. Finally, I hoped to begin my professional career at IPConfigure, ideally achieving a full-time position at this organization post-graduation. The main objective of my internship is to assemble, image, and ship as many servers as possible while ensuring no mistakes are made. The process of assembling the servers involves beginning completely from scratch as each component is sorted onto pallets and labeled. From there, it is my responsibility to assemble the servers, troubleshoot, and ensure that they meet the quality standards set by IPConfigure before reaching their final quality control check. Once I have completed these steps, it is my responsibility to box and pallet the servers so that they can be shipped, ideally on the same day they are assembled. In this reflection of my time at IPConfigure, I will explain the day-to-day interworkings of my position, my achievements while working for this organization, the obstacles I have faced, and finally, my overall goals with my continued employment.

Initial Orientation and Background

My first introduction to IPConfigure was a virtual interview in which I was introduced to my direct supervisors and given an introductory tour of the facility and our product, Orchid VMS. During this initial meeting, the complexity and value of this software were presented, outlining the organization's dedication to innovating and growing as a competitor in the video surveillance industry. IPConfigure was founded in 2003 by our CEO, Christopher Uiterwyk, a U.S. Navy veteran, ODU alumnus, and a member of Greek life at ODU. Chris has a very active role in the organization, making efforts to interact with his employees at all levels of the organization. While I have only had brief conversations with Chris, he is generally very charismatic. He makes efforts to ensure that the employees of IPConfigure are adequately equipped and have a comfortable work environment. IPConfigure HQ is located in an old factory in Lambert's Point that was renovated and officially opened in 2020. Before this, our HQ was located in the ODU Innovation Research Park. The current IPConfigure HQ encompasses many aspects of the original factory, as even some of the floors are original, although they have been restored. When walking around the building, you will notice many historical pieces, including original brick walls and even a winch from the original factory that is now displayed in the office. IPConfigure's current location encompasses more than just IPConfigure itself, as many businesses, including Afterglow Brewing and FR8 House Coffee, rent space from Chris and have great relationships with IPConfigure and its employees. The current IPConfigure HQ includes ample space for its operational needs. IPConfigure HQ includes multiple offices, meeting rooms, a warehouse, a secure storage area, an assembly room, a gym, two kitchens, two break rooms, and a dedicated work area for the maintenance of previously assembled servers.

My first week at IPConfigure primarily involved being trained on the DT (Dollar Tree) variation of the SteelFin server. During this period, there was a learning curve in terms of memorizing the proper order in which components were to be assembled. My training began with a brief overview of the company policies, which I then had to review and sign as part of the onboarding process. From there, I started building my first server. The first step in this process was to identify the order number for the servers actively assembled. All of the relevant information regarding the servers being assembled can be found on a sheet of paper attached to the pallet containing all of the servers' components. This sheet of paper is moved to a pillar in the middle of the assembly floor during the server production and is used as a reference for both assemblers and management. Ensuring that management can properly document the progress of server builds is a critical aspect of my role in the organization. This included the need to record what tasks I completed throughout the day and how much time I spent on each task. From the assembly process, I was then instructed on how to properly rack and image the servers after assembly. This process was somewhat stressful to learn, as the DT model of server has a power supply that must be manually switched to the voltage used by the server rack. If not properly switched before being plugged in on the server rack, the power supply will burn out, causing a loud popping sound and some smoke. While most of the components in the server are salvageable after an event such as this, it still hampers production and is overall detrimental to the workflow. During this period, I frequently asked questions and looked to my coworker, who was responsible for training me and providing guidance.

IPConfigure assembles and sells a wide variety of servers for countless different organizations, both large and small. Some of IPConfigure’s biggest clients include McDonald's, Dollar Tree, and WAWA. Customers can choose from a set list of server configurations or

request specific modifications and variations of existing configurations. For the most part, large organizations such as McDonald's request a large quantity of servers built to the exact same specifications for simplicity in resource management and supply chain demand. Although my position revolves around the hardware aspect of IPConfigure's products, Orchid VMS (Video Management Software) is the primary product developed and sold. Our slogan for Orchid VMS is "Video Made Simple," from my experience with this software, I can whole heartedly atest that this product offers unmatched simplicity for users while also providing numerous beneficial features such as the ability to block recording of specific areas, or the ability to isolate movement or events in a specific location. This feature was presented during a company meeting in which the presenter selected tire tracks in a flowerbed in front of the building. The result was comical footage of another employee who had accidentally gotten a forklift stuck in the mud a few days prior. The ability to highlight a specific area of a camera's video feed and retrieve all relevant footage is undoubtedly a massive benefit for customers.

Managerial Environment

The managerial structure of IPConfigure is unmatched compared to any other organization that I have been a part of. For my position, I have three main individuals to whom I report. The highest position I report to is that of the director of technical services, Jason Mayo. However, my interactions with Jason are generally limited to performance reviews, as he is responsible for managing an entire department, including the two individuals that I report to directly. Stephen Freedman is a Systems Support Engineer, Level 1. Stephen is below Mark Geraghty in terms of management; however, he is generally responsible for assisting with troubleshooting issues and passing information directly from Mark. Mark Geraghty is my direct supervisor; Mark is a Senior Systems Support Engineer level 4 and directly handles scheduling, assignments, and is

responsible for signing off on any paperwork required by my position. Mark is present in all of my performance reviews and is by far the person I interact with the most in terms of management. Mark makes a genuine effort to build relationships with everyone in my department and regularly visits the assembly floor to monitor the progress of builds and ensure that no issues require his attention. Whenever there is a damaged component resulting from either an assembler error or simply a defective product, Mark is responsible for signing off on requisitions of new parts and documenting the incidents. Apart from direct interactions with management, we also have cameras in the assembly room and warehouse that can monitor what orders are currently being worked on while ensuring that employees remain on task and engage in safe workplace practices.

The current management structure at IPConfigure, as it exists, is extraordinarily effective. Currently, my department consistently meets and exceeds quotas with minimal intervention from management. Currently, if management is required to become deeply involved in any aspect of the assembly process other than quality control, it is a significant issue, such as a troubleshooting error that requires advanced knowledge of hardware and software. Whenever a minor problem that requires management to be notified occurs on the assembly floor, Stephen is the go-to guy as he began his career at IPConfigure as an assembler and has unmatched knowledge of the assembly process and hardware troubleshooting skills. Mark, on the other hand, can diagnose and resolve most software issues that we encounter effortlessly. With that being said, there have been several days when I was the only assembler working, and both Mark and Stephen would take breaks from their work to assist me with my tasks to ensure that production remained on schedule.

Major Work Duties

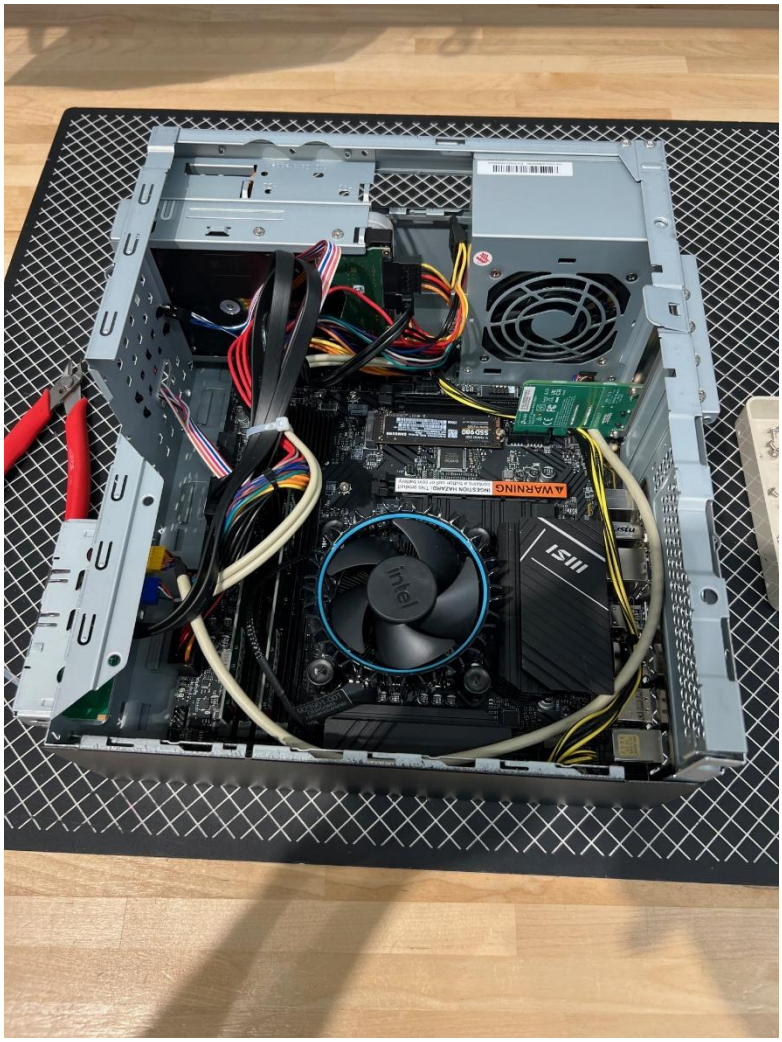
Throughout my time at IPConfigure, I have been assigned many tasks depending on the organization's needs. My main task has always been assembling, imaging, boxing, and securing servers on pallets before shipping. The process of assembling servers begins with the warehouse workers bringing a fully kitted pallet containing all of the components necessary to build a server to the assembly floor. The next step involves attaching the order slip to a pillar in the middle of the assembly room. From there, the assemblers sort the parts and place the required number of parts on each work station. These components include a motherboard, CPU, RAM, M.2 SSD, HDD, Network Interface Card (NIC), and finally, the chassis. The image below displays what the distributed parts look like prior to assembly of the motherboards. The server chassis are generally stacked on the floor next to each assembly station.

When assembling a server, the first step is to add the necessary components to the motherboard. The first component to be installed on the motherboard is the CPU. It is critical to be careful

when installing the CPU, as it is by far the most fragile component of the server. It is easy to accidentally bend a CPU pin on the motherboard while completing this step. In order to avoid this, the CPU must be properly aligned with the motherboard, and the triangle on the corner of the CPU must be matched up with the triangle on the motherboard. Fortunately, I have never damaged a CPU during this process. After installing the CPU, the next step is the CPU fan, this step involves pushing the clips into the motherboard until an audible click is heard, then the CPU fan power connector must be connected to the motherboard, this power connector is located at the top of the motherboard and labeled "CPU FAN." The SSD is the next component to be installed, this process is simple as it involves installing the M.2 standoff screw then carefully inserting the SSD into the M.2 slot before securing it to the motherboard with the included screws. After ensuring that the previous components are properly installed, the designated number of RAM sticks (usually two eight GB sticks) are installed. This is achieved by lining up the RAM sticks with the second and fourth slots from the CPU and pressing firmly until an audible click is heard. It is essential that the second and fourth slots are used for the RAM sticks, as any other configuration of the two sticks will result in the server failing to boot or will cause issues later. Finally, the SATA cables are installed on the motherboard. This step can be done later based on personal preference, although the risk of forgetting to install the SATA cable becomes greater with this practice. Below is an image of motherboards prior to being prepared.

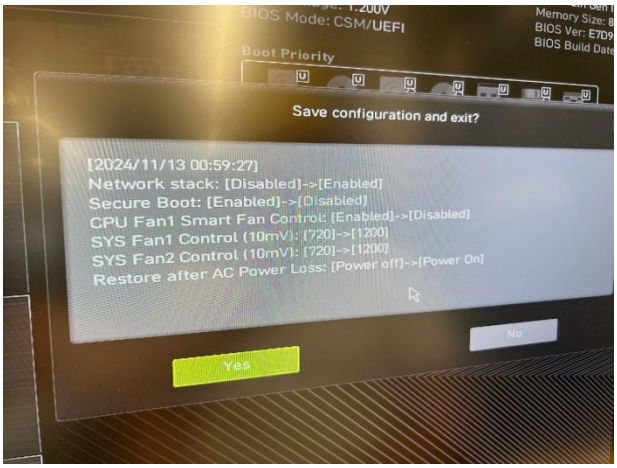
The CPU and CPU fan are included in the CPU box, while the motherboard, SATA cables, and IO shield are included in the motherboard box. After assembling the motherboards, the next step is to unbox and disassemble the chassis. From there, the IO shield is installed into the chassis, followed by the fully prepped motherboard. When installing the motherboard, it is important to handle it with care so as not to cause damage during this process. After seating the motherboard in the chassis, the next step is to secure the motherboard to the chassis using the included chassis screws. For most of the screws in the server build, we are permitted to use drills. However, certain components, such as the HDDs and SSDs, require handheld screwdrivers. Once the motherboard has been properly secured within the chassis, the HDD must be installed into the hard drive cage. Before installing the removable hard drive cage, the chassis cables must be connected to the motherboard. These cables include the motherboard power, CPU power, audio, USB 2.0, USB 3.0, power switch, reset switch, power LED, and finally, the HDD LED. After all the cables have been plugged into their respective ports, the next step is to install the NIC, this

involves removing a chassis screw, inserting the NIC into the PCI-Express port and securing the card in place with a screw. After this Step, the hard drive cage is installed and secured. The hard drive cage must be installed correctly, as misaligning the hard drive cage can cause the hard drive to break loose during shipping and destroy the server. After installing the hard drive cage, the HDD power and SATA cables must be plugged into the HDD. Once I have ensured that every component has been properly installed, the next step is to cable manage, ensuring that the cables are secure, neat, and in no way impeding the CPU fan. Below is an image of the internals of a fully assembled DT server.



The next step in this process is to plug in the server at the test bench to ensure that the server is functional. This is achieved by pressing the power switch, waiting until a white light is displayed on the motherboard, thus confirming that the server has been assembled properly and has no immediately visible issues. Once I have verified that the server is functioning correctly, I unplug the server, reassemble the chassis, and place a sticker with my initials on the outside, verifying my work. The server is then placed on the table located behind my workstation, which holds all the completed server builds for the order. After this, another assembler and I must verify that all servers have been switched to the appropriate voltage before being moved to the rack. If this step is not properly completed, the results can be a damaged or destroyed server. After this, the servers are transferred to the rack and plugged in. Depending on the configuration of the servers, a different number of servers can be placed on each rack. For the DT Servers, ten can be placed on each rack, as a DT order consists of twenty-five servers, three racks are used, two housing ten servers, and one housing five. When plugging the servers into the rack, it is important to once again verify that they have been set to the right voltage. After ensuring they are set to the correct voltage, I plug them into the rack, skipping every 3rd number. Several connectors on the server rack are plugged into the servers, including an Ethernet cable, a power cable, and two USBs for the mouse and keyboard. After plugging in all the servers, they must be individually powered on. From there, I go to the terminal to ensure every server displays correctly. I then wait for the servers to display the boot screen. From there, I enter the BIOS and ensure each server is configured correctly before installing Linux. Should a server fail to boot or have any other issues, I then move to troubleshooting. In most cases, I can figure out the issue myself. However, if I am unable to, I first consult another assembler, and if we are unable to resolve the issue, we then contact either Stephen or Mark. Generally, at this stage of the assembly process, any errors

result from software issues or a defective component. Below is an image of a server configured correctly in BIOS before being imaged, and a rack containing DT servers.



After the servers have been imaged, Mark gets a notification on his workstation informing him that we have completed our task. From there, Mark uses Ansible to configure the servers. After this step, I am responsible for placing the serial number stickers on each machine. This requires care, as placing the wrong serial number on a machine is a major issue for support. After this process is complete, someone from support then enters the assembly floor and performs a quality control check on all of the servers, filling out quality control sheets that are then shipped with each individual server. Finally, the next step is boxing and preparing the servers for shipping. This involves placing the boxes for all 25 servers on the table, placing the proper shipping labels on the boxes, and distributing sheets including a startup guide, the quality control sheet, and other information for customers, with the boxes. After this step, each server is placed in front of

the box with the matching serial number. We then carefully box each server, after each server is boxed, the next step is to place the boxes on the palette. We then wrap the palette in plastic wrap, and place straps on the palette securing it. After the pallet is secured, we place stickers that are used for shipping and identification. Once this process is complete, we can then inform Mark and move the pallets into the warehouse to be shipped.

Besides the servers' assembly, I have many other duties and responsibilities at IPConfigure. These include manually logging my hours, which include the tasks performed and the hours required to complete them. These hours must be submitted to Mark at the end of each day for his records. My department has also been required to perform other duties at the office. Including, in rare cases, unloading trucks containing components for servers and disassembling servers that have been shipped back to IPConfigure for various reasons. Another aspect of our job is the repair and maintenance of servers. In some cases, these servers come back in extraordinarily rough shape, such as McDonald's servers being shipped back completely caked in grease as they mount many of their servers above their fryers. Other examples have been servers that have been returned destroyed, such as one that was in a fire and another that was damaged by unknown means. Below are images of a server that came back severely damaged and was unsalvageable.

All of my tasks are critical to the continued function and success of the organization. The building and maintenance of servers is one of IPConfigures' most significant selling points to customers. While just about every member of support would be capable of performing our duties, they would not be able to perform them and their jobs to the standard that IPConfigure expects. My department's ability to perform a multitude of tasks with efficiency ultimately allows IPConfigure to function in situations where other departments would struggle alone. For instance, a major order of servers was returned to IP configure. As a result, a different department was responsible for disassembling and placing components back into storage. However, they were understaffed for the day, and we were able to assist with the process of disassembly and sorting of parts for storage. Given the amount of time I have spent assembling servers and doing maintenance, I could quickly disassemble the servers and ensure that the components were not damaged during the process.

Use of Cybersecurity Skills

I began my internship at IPConfigure with a good foundation in basic cybersecurity skills and practices. However, my time at IPConfigure has led me to gain a deeper understanding of how these skills can be applied to the workplace. One of the biggest examples of this would be that IPConfigure is a secure facility. We must badge into the building using company-issued key cards and are not allowed to hold doors for anyone, including other employees. Another use of cybersecurity skills could be the requirement for strong passwords for company email accounts and using YubiKeys when accessing confidential information. Throughout my time at IPConfigure, I have received phishing emails on almost a daily basis and have successfully avoided them. These phishing emails generally come in the form of a message from our CEO, generally claiming something about a promotion or a project for which my "technical expertise" is needed, requesting my personal phone number and other information. However, looking into these emails, it is clear that they are sent from fake email addresses. There is also the issue that company communication takes place generally over Google chats rather than email. I feel as though IPConfigure has grown my knowledge of cybersecurity, as I have become significantly more familiar with the hardware aspect of IT, and I am currently on track to gain a support position, which will undoubtedly further improve my skills.

The ODU Curriculum

My time at ODU has helped me in many ways in my internship. First and foremost, the networking skills that I have gained from my time at ODU ultimately led to me getting this. Internship. Apart from the networking skills, the ability to quickly identify and report phishing emails was a major Benefit. Overall, I would argue that my most beneficial class today has been

CYSE 270, as this course gave me a deeper understanding of Linux. As IPConfigure primarily uses Linux for its systems, confidently using the terminal and understanding the information I was reading allowed me to excel in my position. However, given the nature of my position, I would argue that many of the skills I have learned from my time at ODU did not directly apply as my position is less cybersecurity oriented than related to IT support and hardware. However, as I have discussed with many individuals in the cybersecurity field, an IT help desk position is one of the best starting places as you gain a deep understanding of hardware and interact with individuals who generally have less knowledge related to Cybersecurity, allowing me to understand where an attacker may look for vulnerabilities when attempting to utilize social engineering. Overall, while gaining a deeper knowledge of Linux from my time at ODU was invaluable to my position at IPConfigure, the greatest asset I gained was my confidence when addressing technical issues, such as knowing acronyms and understanding the importance of security and protecting sensitive information.

Internship Outcomes

I feel I have achieved every outcome I wanted when I initially applied for my internship at IPConfigure. My first goal during my internship at IPConfigure was to gain a deeper understanding of the process involved in assembling servers to an industry standard. I feel as though my knowledge of the assembly process has advanced to a level that I can truly be proud of. While my experience and knowledge regarding more advanced multi-CPU servers is still somewhat limited compared to my knowledge of configurations such as the WAWA and DT server, I still have the necessary skills and experience to complete these builds to a high standard and in an acceptable amount of time. Secondly, I have gained a deeper understanding of Linux as an operating system. At the same time, I had previously used Linux in classes such as CYSE

280, IPConfigure, and especially Mark has taught me a lot about how the operating system functions. Ultimately, I memorized multiple Linux commands related to my work and can confidently use the Linux terminal to perform tasks. However, I have not fully met my final goal of beginning my professional career at IPConfigure and achieving a full-time position post-graduation. I have taken the first steps as I have begun my professional career at IPConfigure and have talked extensively with Mark about a full-time position after graduation. Furthermore, I have been given new responsibilities and informed of their intention to begin training me for a full-time role in the organization.

The Most Motivational Aspect of This Internship

The most motivational aspect of this internship has undoubtedly been the environment created by both the company itself and my coworkers. I feel as though I have made close connections with the people in my department and my supervisors. From the beginning of my internship, I have been encouraged to learn, and it was acknowledged that mistakes were expected, particularly in the first 30 days of my internship. Overall, the work environment is laidback yet still formal, allowing for an enjoyable work experience while still maintaining the expectation of professionalism. I have had several performance reviews during my time at IPConfigure, and the result of each has been compliments regarding my work ethic, motivation, and organizational skills. While not guaranteed, discussing the possibility of a full-time position after graduation has undoubtedly been a key source of motivation to continue working to improve my abilities regarding assembly and grow my knowledge of Linux and the Orchid VMS.

Most Discouraging Aspect of Internship

The most discouraging aspect of this internship is, by far, making mistakes. The only other issue that comes close is that we had several instances of not working for weeks at a time due to a lack of new orders being placed. While I take great care to ensure that I do not make mistakes or damage server components, the unfortunate reality is that it is impossible to completely avoid making mistakes. While I have not made mistakes like forgetting to ensure that a power supply is set to the correct voltage before plugging it into the server rack, I have forgotten to plug the SATA cables into the HDD's on several of my builds, while this issue was realized during the quality control stage of assembly, the result still hampered production and in one case lead to an order being delayed. It can undoubtedly be hard to overcome the feelings associated with making mistakes such as these, particularly when your mistakes inconvenience others or have a negative impact on production numbers. However, it is important to remember that mistakes will happen and that it is important to learn from those mistakes and take measures to avoid them in the future.

My Recommendation for Future Interns

I have several recommendations for future interns at IPConfigure. First and foremost, be honest during the interview regarding your technical knowledge and experience with hardware. If they know that you are inexperienced, they will take extra care in training you and ensure that you are not given tasks that you are unprepared for. Secondly, approach this internship with a willingness to learn and adapt to the environment. There are many ways to build a server. However, the process that I was taught at IPConfigure is far more efficient than the methods I used previously when building personal PCs and servers. Being open to constructive criticism

and learning from your mistakes will help you to thrive at this organization. Another piece of advice for anyone looking to get an internship at this organization is to take time to get to know the people who work there. I spent a significant amount of time getting to know my coworkers and managers, and I can confidently say that you will likely learn more from their personal experiences in the workforce than you will just about anywhere else. For example, I recently did an interview with my supervisor, Mark. During this interview, he outlined exactly what is required to achieve his position and how he decided upon his career path. Finally, and perhaps the most important piece of advice I can give is to ask questions. Asking questions when you have any form of doubt or concern in relation to a task or process is undoubtedly a good practice, as it will allow you to minimize mistakes while gaining a deeper understanding of how the business functions.

Conclusion

In conclusion, my experience with IPConfigure has undoubtedly been one of the most influential aspects of my college and professional career. This internship has provided me with unparalleled knowledge of hardware while also providing an introduction to software and OS applications. Starting from possessing only a basic knowledge of computer hardware, I was able to learn the entire in-depth process involved in assembling and repairing servers. While the beginning of my internship had a large learning curve that involved several mistakes, these mistakes ultimately served as learning tools that improved my knowledge and skills. Working at IPConfigure, I have had access to and worked with technology that was previously inaccessible not only due to the price but also the skills necessary to properly configure the devices. Having such a friendly and professional environment for my first internship will undoubtedly be beneficial long term, as I have witnessed what it is like to work for an organization that cares for

its employees and makes efforts to ensure that morale remains high and every individual feels valued and appreciated for their efforts.

With that being said, preparing for this internship was by no means easy, as I spent countless hours reviewing and improving my resume before initially applying. There was also an issue with my application being sent to the spam folder, which was resolved by reaching out to IPConfigure on several occasions to resolve the issue. However, from the moment of the interview to my first day, I knew that this organization held a lot of potential for my career. While there have undoubtedly been many challenges and struggles associated with this internship, including my initial application. Overall, these struggles have helped me to grow and prepare me for the challenges I will undoubtedly face throughout my career. Overall, the main lesson I learned from these challenges is persistence and resilience. Gaining a deeper understanding of both technical procedures and professional workplace dynamics has laid a foundation for both my remaining college years and my long-term career goals. I now have a deeper understanding of how the theories and technical skills we learn in the classroom can be applied in the real world. For example, concepts like Linux commands, hardware configuration, and cybersecurity best practices, which were previously just content covered during lectures and labs, became significantly more impactful once I began using them every day at IPConfigure. This realization has completely altered how I plan to spend my last year at Old Dominion University. I now plan to pursue a full-time role in IT support, with the goal of earning certifications such as CompTIA Security+ and Network+ prior to graduation in order to further improve my skillset.

More than anything, this internship has taught me that, above all else, experience is an invaluable asset to any organization. It is one thing to learn about IT and security policies in a lecture, and

something else entirely to troubleshoot a server or encounter a real phishing attempt. Every server assembled, every support issue resolved, and every mistake corrected contributed to a growing level of confidence in my technical ability. My internship also made clear that effective communication, a willingness to own up to mistakes, and the desire to ask questions are just as valuable as possessing technical skills. Overall, these lessons will undoubtedly benefit me during the rest of my time at ODU and through my professional career.

Looking forward, my internship has drastically influenced my vision for my career. Before this internship, I had a general idea that I wanted to work in cybersecurity. However, I now have a clear path forward and applicable experience in Cybersecurity. This internship has provided me with more than just technical knowledge. I have learned a lot about my strengths and weaknesses, and learned to be comfortable with mistakes. I now understand the benefits of a positive work environment that can help me to grow, and what it is like to have coworkers and supervisors who want me to succeed. I am grateful to IPConfigure for the opportunity that they have given me and that Old Dominion University has required me to gain this experience prior to graduation, as without it, I would undoubtedly be far less prepared for the future. I believe that the overall purpose of an internship is to help bridge the gap between the knowledge a student learns in the classroom and real-world, applicable experience. If that is the case, then my time with IPConfigure has undoubtedly provided that and much more.