SAMPLE TECH WRITING PROPOSAL INTRODUCTION AND DISCLAIMER

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The inserted Comments indicate only that all required TaskStream sections are present, not that they are correctly completed for all types of projects. The best that can be said about the original work is that an evaluator found the work submitted to be sufficient to the task. Viewing this sample may or may not produce a similar result for you.

Bottom line: You are the author of your work. We hope this sample helps to dissipate some of the uncertainty that surrounds the Capstone Project, but it cannot guaranty a trouble-free process.

IMPORTANT: For maximum benefit, carefully compare this report to its successor.

Technical Writing Project Cover Sheet

Comment [t1]: A. Cover Sheet: Provide a cover sheet for your proposal that includes the following elements:
a. Project name
b. Your name
c. Your degree program
d. Your mentor's name
e. Signature block (A space for your mentor's signature and your signature and the date. This will be signed by your mentor when the proposal has been approved.)

Capstone Proposal Project Name: Prouder Software Network Upgrade

Student Name: SAMPLE

Degree Program: SAMPLE

Mentor Name: SAMPLE

Signature Block

Student's Signature SAMPLE

Mentor's Signature SAMPLE

Contents

Capstone Proposal Summary

Comment [t2]: B. Introduction (suggested length of 5–8 pages)
1. Provide a summary of your project.
2. Provide a review of what other work has been done in this area.
3. Provide a rationale and systems analysis for your project.

As the world becomes progressively more reliant on data driven technology, businesses can no longer ignore the necessity of a dependable communications network for success. Because some companies tend to utilize with cut-rate, inefficient hardware in their networks, the consequences are increased employee frustration leading to decreased customer satisfaction and ultimately reduced revenue. This project focuses on a fictional development company facing those very issues. Prouder Software is a small software development company with approximately 100 employees. Their main headquarters is located in Arlington, Massachusetts and they also maintain a small branch office in Virginia Beach, Virginia. Prouder hopes to expand to a third location in Fresno, California within the next year. Prouder has been relatively successful creating productivity apps for iOS and Android. With business booming, they have dealt with rapid growth within their organization. This consequently had an unforeseen result affecting network performance. As more new employees came on board, problems began to worsen. Employees would constantly complain of intolerable, slow network response times, making it nearly impossible to accomplish even the simplest tasks. It was only when the CEO started having difficulty accessing his email did management finally determine something had to be done. No longer could the company be subject to the limitations of a dated computer network. With this charge, management has requested that the network team pull together a formalized proposal detailing a plan to completely refurbish the corporate network infrastructure with the goals of resolving slow network response times, increasing overall capacity, and providing adequate support for growth.

As part of the preparation for this project a systematic evaluation of the existing network architecture and all its dependent systems was performed. The outcome of the assessment would

serve in ascertaining which areas had the most room for improvement. During this investigation we found that while many of the clients on the network were modern, high performance machines, the underlying network infrastructure was deficient of apt equipment. A greater part of the hardware used in the network are consumer grade devices aimed at supporting small office/home office environments. They were not designed to handle the needs of these data hungry clients. Such devices aid in creating an unsophisticated network, but does not provide the means to support a full scale enterprise operation. The growing pains presently felt by employees points directly to corporate use of substandard hardware.

Before any serious effort at planning takes place, we needed to fully understand the requirements. To accomplish this we met with key stakeholders, including the operations manager, development lead, and senior production engineers and asked for their contribution. As their jobs depended immensely on the network, it is indispensable that their interests and needs are included in the development plan. The consensus among all the individuals we spoke to was the need of increased bandwidth and throughput capacity. They explained data traffic to their off-site storage is chronically hampered by their slow WAN connection and even local transfers between hosts seem to be suffering the effects of internal bottlenecks. Due to the substantial impact on the productivity and efficiency of their staff, management will be looking for the new infrastructure to have ample capacity to cope with all daily production traffic and that would also be scalable to sustain future expansion. As part of this matter, they expressed an interest in including redundancy for increased availability. Past network outages resulted in the loss of entire days worth of work and missed deadlines. Management would like to ensure that critical outages can be avoided by having multiple connections to the Internet.

With the information supplied by the stakeholders and with management's approval, the initial steps of planning and designing the new network could commence. A study was performed on what network options were available. The end systems, client devices, and other like systems are out of the immediate scope of this project. Our attention will be squarely on key infrastructure components that supporting network framework including the following:

- Routers & Switches - Pulver vs. Nocturn
- Internal Wiring – Cat5e vs. Cat6
- WAN connection – DS1 vs. DS3 vs. Flare Ethernet

Because Pulver is ubiquitous in the business world, the decision to set up Pulver devices was our leading choice; however, at the request of management to review at least two alternatives, we also reviewed hardware available from Nocturn Networks. Cabling upgrades were discussed as our investigation reviewed that the current building infrastructure did not support new Cat6 standards. A proposal to upgrade the wiring was included in the plan. We also executed research on ISP connectivity options offered in the respective markets for a cost-effective WAN solution. At the conclusion of our research and analysis, a list of deliverables was compiled where an expense estimate could be tabulated from and a projected timeline proposed for the implementation of the new network.

By and large the main objective of this project is to deliver improved network performance in a solution that surpasses management's expectations and is within budget requirements. At the termination of the project we will provide management a cost-effective, stable network that will not only provide a perceptible improved experience, but also feature a scalable and "future proof" framework to support continued growth. With improved productivity and employee satisfaction, management will recognize that the new network will

endow Prouder Software with a competitive edge critical to outclass its competitors in the market.

This design proposal will highlight Pulver's *Prepare*, *Plan*, *Design*, *Implement*, *Operate*, and *Optimize* (PPDIOO) network life cycle methodology. Completion of each phase of this design style ensures the successful execution and operation of the network. Seeing as this is a preliminary proposal, the *Implementation* phase will be incorporated in the final capstone, and *Operate* and *Optimize* phases will be out of scope for this project.

Review of Other Work

Comment [t3]: B. Introduction (suggested length of 5–8 pages)
1. Provide a summary of your project.
2. Provide a review of what other work has been done in this area.
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Because of our widespread familiarity with Pulver devices, the preliminary proposal was to make use of all Pulver hardware in the new implementation. However, since management sought to have several alternatives available, we assessed Nocturn Networks' hardware portfolio. What we found was fairly impressive in terms of reliability and customer loyalty. Nocturn's modus operandi seems to build upon developing a best in class, no frills solution for its hardware. As such, a router is a router and nothing more. No frills, all function. This leaves very little option for modularity, especially in cases where customers desire an all-in-one solution.

> "With all the heavyweight backing, Nocturn became and is still Pulver's most formidable challenger in service provider routing. The company gradually attained a roughly 30% share of the $8 billion market, virtually all at Pulver's expense, and has been the technological darling of some bitheads over the past decade for the purity – or purpose-built specialty – of its silicon and software.
>
> This remains Nocturn's chief differentiator from Pulver. Pulver was viewed as a packager of enterprise-class products that were being deployed in more demanding service

> provider requirements. Pulver's dominance and ubiquity in routing made many of its customers hungry for an alternative." (citation, year)

Another major difference between the two vendors is their hardware operating systems. Contrasting Pulver's IOS, the MICROPALE software is a homogeneous release and the same image is used across all of Nocturns network appliances from routers to firewalls (citation, year). According to Nocturn, this facilitates deployment of software upgrades to the network devices and offers scalability to maintain the pace with evolving networks. This was a very persuasive feature that Pulver is under pressure to contend with. Adopt Pulver's hardware functions on several different operating systems (IOS, IOS XE, IOS XR, and NX-OS), all with variations in releases depending on each hardware platform. System management can be an overwhelming chore as engineers and technicians will necessitate knowledge for the proper syntax of commands within each operating system.

Because of our unfamiliarly with Nocturn further research was needed in order to provide an unbiased opinion. Exploration on the web provided a lot of the same back and forth banter between Pulver advocates and Nocturn loyalists. One particular engineer's succinct viewpoint on the differences of the two afforded us insight to the course both companies were taking.

> "The choice between Pulver and Nocturn comes down to a few key decisions and requirements, and an example of Pulver and Nocturn's differing mentalities is relevant here. Pulver for many years has been manufacturing "jack of all trades" machines, for the most part, its routers and firewalls are meant to do a great deal more than routing and firewalling, respectively. Pulver's ASAs can function as routers for small businesses, and Pulver routers often contain VPN, remote entry, and even Ethernet switch add-ons. The intent here is clear: Pulver is creating versatile and multi-purpose machines, so that

> an enterprise may not need eight different machines for their firewall, VPN, router, etc. They just need one box that saves space and unifies everything in a clear, clean way. Nocturn takes the exact opposite approach, which focuses on specializing their machines for as much speed as possible. To put it simply, if you buy a Nocturn router, you are getting a Nocturn router, nothing more nothing less. The company has recently been experimenting with Pulver's model of offering more versatile boxes, but for the most part if you are buying Nocturn you are buying it for specialization and speed." (citation, year)

Management made it clear to us that they desire a straightforward, manageable design. If it can be done with one box, do it. Furthermore, the implementation of Nocturn devices would require the learning the MICROPALE operating system requiring precious time. Not discounting some of the key advantages of Nocturn, the final decision was to go ahead with Pulver as our vendor of choice because of the ability to rapidly deploy the network without having to deal with new code.

To address the concerns of WAN link congestion and network redundancy, inquiries to multiple ISPs regarding connectivity options was carried out. Like many businesses in their class, Prouder uses a T1 line for dedicated Internet access. With speeds of 1.544Mbps, a T-1 (or DS-1) connection is typical for most small branch office environments, however this proves to be insufficient to sustain intensive usage. For data rich applications, business in general purchase DS-3s. Offering 45Mbps of available bandwidth, DS-3s are the preferred broadband solution for hauling bulk data. In recent years, Flare Ethernet has become increasingly more popular with small businesses. Allowing for conventional LAN speeds of 100Mbps up to 10Gbps, Flare Ethernet has a comparative pricing structure equivalent to DS-3 connections. Several points made Flare Ethernet a more plausible solution. The first being the ability to

purchase bandwidth at 1 megabit intervals. The same can be had with a fractional DS-3, however pricing was not as competitive. Second, because Flare Ethernet seamlessly can mesh the two existing our internal LAN infrastructure can appear as one large network domain. We discussed the pricing options with the local Telco as well as delivery time frames and came to the conclusion that Flare Ethernet would offer the most flexible options for our needs. The actual provisioning of the circuits would require at least 60 days of lead time for the orders to process and be delivered on site. To expedite the process of approval from management, we would initiate the order process for both offices concurrently to meet our projected deadlines.

Rationale and Systems Analysis

As it is essential to have a proper design methodology, the Pulver PDDIOO method will be used. The preliminary part of which, *Prepare*, is unquestionably paramount to the success of our project. Executing a comprehensive technical analysis allows us to characterize the network in its existing form and make a detailed gap analysis. The outcome of the investigative process will allow us to approach the *Design* phase. During this part of the project we would devise a design that will appropriately meet all the requirements necessary to tackle the performance problems within the network. From this we are able to present tangible evidence of current design insufficiencies to management for a justification to proceed with our project through the *Implementation* phase. Again, the final components of *Operate* and *Optimize* will follow through the life cycle of the network and is out of the current scope for this project.

To assess the magnitude of the problems, we spoke with those who felt the most pain: the end users. What was consistent with all the users we conversed with was a lack of bandwidth. Some users stated it would take over 10 minutes each day to download their email. Others observed that uploading files to locally attached storage devices was taking an unusually long

Comment [t4]: B. Introduction (suggested length of 5–8 pages)
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Comment [t5]: This is the design methodology.

time. Some even perceived that they were on some kind of decades old dial up connection. The message was everywhere and with everyone we spoke with. Users were time and again starving for capacity at it was severely hampering their efficiency and, ultimately, Prouder's bottom line. They unquestionably *needed* to deal with their capacity problem.

To properly evaluate how the network traffic behaved, we commenced a study into usage patterns, application needs, and analyzed the architecture for possible indications of what root causes could be impacting their network responsiveness. We spent a few days with the some developers to monitor network behavior during normal operating hours. This permitted us to see to see first-hand what the users were encountering. During the beginning of the day, the network speeds appeared optimal. We created a baseline by transferring a 20 megabyte file across the T1 WAN link from Virginia Beach to Arlington and recorded the response times. We repeated this once every hour on the hour as the day progressed, logging each result in a table. As more employees started to trickle into the office, we noticed that the file would take markedly longer to transfer, ultimately timing out and failing around noontime. We consulted the operations manager and asked him what, if anything, would be occurring during the afternoon. We discovered that Active Directory replication was scheduled during this time. We questioned as to why this had to occur during the middle of the day and was advised that their data backups happened during the evenings and it was accepted that lunchtime would be suitable enough since most engineers would be out to lunch. Network traffic analysis showed that users who didn't leave the office for lunch often times would watch YouTube and Netflix at their desks. We concluded that the T1 was insufficient to handle their critical traffic and that an upgrade to at least a 50Mbps connection would be appropriate.

The physical inventory of the LAN hardware produced some very remarkable findings. At the core of the network, we found a series of hubs. A hub is a rather cost-effective means to connect multiple network segments together. They do this by regenerating signals they receive and rebroadcasting it to all hosts connected to it. Because they lack the intelligence essential to make switching decisions the excess chatter can bog down a network considerably. Modern networks make use of switches in place of hubs for their efficiency. It appears that Prouder technicians overlooked this key part of their infrastructure when standing up their initial network. Justifiably so as small hubs and switches appear to be similar devices on the outside. We can safely deduce that these hubs are the ones responsible for the network slowness that end users are complaining about.

At the border of the network, we found an older model Pulver 2500 series router. We assume that this router was installed by the ISP as a low-cost answer at the time of the delivery of the T1 line. We were astounded to find one in the wiring closet as they have been at end-of-life/end-of-support for over a quite some time. One can probably find a pallet of a hundred of these on eBay for $10. Needless to say, they are ancient machines. Since one of the requirements made by management was for the network to be scalable, the 2500 was not going to cut it. A far more modular answer would be the Pulver 2900 ISR series. The new ISR platform offers multiple chassis configurations with a wide range of options for connectivity and value added services, such as integrated firewall and wireless capabilities. Using Flare Ethernet as a WAN solution, the new Pulver 2900 ISR can also provide three on-board Gigabit Ethernet connections to allow for the redundancy management requests without the need to procure additional Ethernet line cards.

With the hardware cataloged, we mapped the network's physical and logical topologies. As a bulk of the hosts were daisy-chained in a string of hubs, the network was relatively flat physical topology. Without an OSI Layer 2 liaison such as a switch in between, all hosts were contending for bandwidth. This is also security vulnerability as any interaction within the network could easily be intercepted by plugging a network sniffer into an open port of a hub. With no logical boundaries as well, all departments had equal access to all resources on the network. We brought this up to the attention to management and suggested the implementation of some new Layer 2 switches with VLANs configured for each department within the company. This would provide augmented network security by breaking up the network into logical segments and effectively restricting local broadcast traffic to each VLAN.

Drawing together our research, we are now able to accurately develop our plan into a logical and concise manner. From this analysis, we can identify four key deliverables for this project: hardware (Pulver 2911 ISR routers, Pulver Catalyst 3560-X switches, and a standalone Panther appliance), circuitry (Flare Ethernet links), software (Physician), and design documentation (topology sheets, test results, configuration). These deliverables will act in unison to accomplish the overarching goal of improving network performance.

Goals and Objectives

The there are two main goals for this project. The first is to overhaul the existing network in efforts to resolve network congestion issues. The second would be to meet the following all the main objectives we have listed. The main objectives for this project include the following nine major points:

1. Develop a design document
2. Configure a prototype network with new network components for testing and validation

Comment [t6]: C. Project Goals and Objectives (suggested length of 5–8 pages):
Provide a precise list of the goals and objectives of your project.

Comment [t7]: Two goals.

Comment [t8]: 9 objectives.

3. Configure a pilot network in Virginia Beach to coexist with the existing network
4. Upgrade wiring to Cat6 cable standards
5. Install and configure a new router and routing protocols for intranetwork and Internetwork routing (EIGRP/BGP)
6. Configure redundant connections to two separate ISPs for high availability
7. Install and configure Layer 2 switches with appropriate VLANs, access control lists for security
8. Install network monitoring agent (Physician)
9. Meet proposed deadlines and remain within the budget scope

In order to attain the preferred end result, all objectives must be accomplished successfully. Each objective represents a critical part of the overall system enhancements to the network. Substandard results with any of one of the objectives would lead to the failure of the project.

Network documentation is vital to the successful deployment and upkeep of any network. Innumerable hours of troubleshooting can be saved with just having available adequate and precise network diagrams. Often times a network is looked after by one individual who also happens to be the only person who knows anything about the network in its entirety. Should one day that individual decides to leave the company, sooner or later something will break. You are then left with a situation where you are scrambling to find bits and pieces and having not even the slightest clue where to begin to look. All the while management is breathing down your neck as business operations come to a halt. The longer the network continues to be down, the closer you get to having to refresh your resume. Needless to say, even the most veteran network engineers would find it challenging to dive in head first without the appropriate information about the ailing network they are attempting to save. Providing and maintaining documentation

is essential for maintaining best practices for operating the network. Much like this proposal, the network documentation would consist of the initial design requirements, the topology of the existing network, the actual design, a proof of concept, the implementation plan, and any appendixes including the hardware cataloged, configurations, and miscellaneous, pertinent information (citation, year).

To guarantee that the new network operates as intended, a prototype network would be stood up. Using the new network diagrams and documentation as a guidebook, we would build an isolated network. Employing the same configurations as we would use in a live production environment, we would be able to precisely test the strength of our design. The advantage of using a prototype is that it allows the evaluation of the network design before it is deployed without affecting a production network (citation, year). Application traffic and comparable network conditions would be simulated to make certain that the proposed network would perform we would expect in a live environment.

After the prototype network has been vetted for stability, a pilot network would be deployed in conjunction with the existing network. Similar to the prototype network, a pilot network allows us to test the network in a live environment, although limited in scope. Because of the restrictions of a prototype network, real-world issues cannot be observed prior to deployment. This solution gives us the chance to scrutinize the new network in circumstances that would arise in day to day operations and allows the opportunity to further optimize whatever may be necessary to improve the design. Since the main offices of Prouder are located in Arlington, Virginia Beach would be an ideal pilot site.

As soon as all the initial documentation is drawn together and both the prototype and pilot networks have been tested, validated, and approved, the true fun begins. To start, new

cables would be run throughout the office space. Normally this is carried out by a building contractor and permits and approvals would be requisite from the building landlord. Most modern buildings are network-ready; however, in the Prepare phase of our plan we found that the site is not wired for Gigabit Ethernet. To ensure we preserve our "future proof" design, it was determined to utilize Cat6 cabling to allow for 10Gbps throughput. Though no devices in our present design support 10Gbps, Cat6 is backwards compatible to existing Gigabit Ethernet standards. The majority of cabling can be prepared prior to hardware installation, and this conveniently allows that portion of our install be completed in anticipation of the delivery of the Flare Ethernet links.

When the cabling completed, the new Pulver 2911 ISR would be installed. The 2911 ISR provides us with three integrated 10/100/1000 Ethernet ports permitting options for multiple ISP connections and one high speed LAN connection. With four available WAN interface slots and one service module slot, the 2911 ISR allows for numerous choices for future expansion capabilities (citation, year). Once racked and loaded with a baseline configuration, the internal routing protocol of choice, in this case, EIGRP, would be deployed. While static routes are easy to configure, they would eventually become far too cumbersome to maintain as additional routes are needed and is not conducive to a scalable design. Fast convergence times within the network make EIGRP an optimal solution for dynamic routing purposes. On the WAN side, Border Gateway Protocol, or BGP, would be used between the edge router and the provider edge router. The proposed design for the interconnect between two networks would utilize Multiprotocol Label Switching, or MPLS. Through the use of MPLS VPNs, both branch offices can act as one uniform LAN over a wide area connection. This will be configured by the service provider with

details transparent to the end-user. We would have the responsibility of accurately advertising and filer routes and expect to do so via dynamic route redistribution.

To provide the high availability required, a multi-homed or dual-homed connection must be deployed. Most companies, specifically ones with mission critical applications, make use of multiple ISP connections to assure that their network is always accessible. This is due to the fact that the likelihood of two ISPs experiencing an outage at the same time an unlikely occurrence. In this situation, we chose a dual-homed design, where the redundant connections will be serviced by the same ISP. Each connection would be routed through separate paths through the ISP backbone network assuring that the redundancy is intact. This was more cost effective in the end as the ISP presented a significant discount with the leasing of two lines. This allows for the possibility of traffic load balancing over the secondary connection. We can accomplish this with very little effort by adding an extra line of configuration to BGP.

Once the WAN is up and active, the LAN becomes the main focal point of the implementation. With the hubs removed, two new Pulver Catalyst 3560-X switches would be installed in their place. These enterprise grade Layer 3 switches offer 48 ports of Gigabit Ethernet connectivity in a stackable configuration. Installing multiple switches in a stacked configuration allows all the devices in the stack to act as one device, each individual switch acting as if it were a blade in a large chassis. This allows for easier management and maintenance over the life cycle of the network. Need more ports? Add another switch. Should one switch fail in the stack, replacement of one chassis would not have a catastrophic impact on the rest of the network. Eventually the acquisition of a Catalyst 6500 Series chassis would be more become a sound investment; however, due to our limited budget, the Catalyst 3560-X is our best option.

Once initialized, the configuration of VLANs would be implemented based on the switches per the design document. Each department would be compartmentalized within its own VLAN, fostering security and bandwidth by limiting excessive broadcast traffic within each VLAN. As a Layer 3 switch, the Catalyst 3560-X has the ability to route traffic between the VLANs without the need of a separate Layer 3 device such as router. This limits unnecessary traffic traversing the uplink to the router conserving precious bandwidth. To further augment security, VLAN access lists would be created to regulate traffic destined between VLANs. This assures nobody goes anywhere they don't belong. Unauthorized attempts can be logged in the local system buffer or uploaded to a remote server for archival purposes.

A network is only good when it's up and running. Monitoring is an indispensable part of network management and regrettably, is an afterthought in most designs. Once the new network is up, we will install a dedicated Panther box for the purpose of hosting Physician. Physician is free, open sourced network monitoring software that can actively observe the health of the network. Using the Simple Network Management Protocol (SNMP), Physician can proactively alert technicians of critical network conditions. Because it is simple does not make it any less potent. There is a great deal of the granularity that can be introduced into the application, such as tracking bandwidth trends and surveillance of traffic conditions throughout the network. Plus, anything free is always welcomed.

The final objective of this project would be to ensure that all activities are carried out within the budget range and the projected timeline. Management has imparted a set budget for the entire scope of the project and it is within our objectives to meet or exceed those guidelines. Due to the number of variables that are out of our immediate control - such ISP delivery of circuits, vendor supply constraints, even weather - it is indispensable that we attempt at all costs

to meet the timeline we have proposed to management. We would hope for the best and expect the worst when it comes to relying on third parties. As professionals, furnishing solid results will guarantee that management is pleased with the end product.

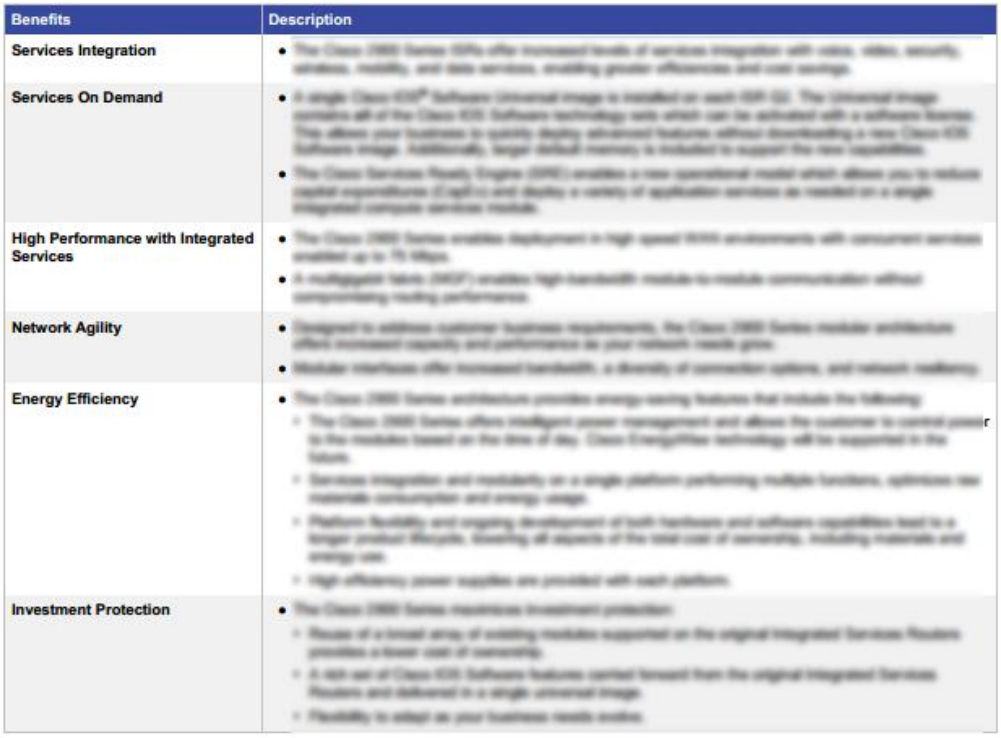
Project Deliverables

The key deliverables for this project are hardware, circuitry, software, and design documentation. Hardware deliverables include new routers and switches, comprising of all associated cabling and supplies, and a small Panther appliance to host the network monitoring appliance. Circuit deliverables include new high-speed Flare Ethernet connections provided by Telco. Software deliverables include the Physician network monitoring application. Design documentation will consist of all the documentation related to this project, including the business requirements, old and new network architecture schematics, and specific design information - including configurations, the proof of concept results from prototype testing, this implementation plan, and all supporting hardware manuals.

The Pulver 2911 ISR is the foremost component of our upgrade. We opted for the 2900 ISR series due its built in design for scalability and modularity. Key business benefits that describe key features of the Pulver 2900 Series ISRs are listed below:

Comment [t9]: D. Project Deliverables (suggested length of 5–8 pages): Explain what types of deliverables your project will provide. (Your project will include some sort of formal report. It will likely also include a technical IT product and/or a user's manual or other documentation.)

Comment [t10]: Deliverables listed.



Benefits	Description
Services Integration	• The Cisco 2900 Series ISRs offer increased levels of services integration with voice, video, security, wireless, mobility, and data services, enabling greater efficiencies and cost savings.
Services On Demand	• A single Cisco IOS® Software Universal image is installed on each ISR G2. The Universal image contains all of the Cisco IOS Software technology sets which can be activated with a software license. This allows your business to quickly deploy advanced features without downloading a new Cisco IOS Software image. Additionally, larger default memory is included to support the new capabilities. • The Cisco Services Ready Engine (SRE) enables a new operational model which allows you to reduce capital expenditures (CapEx) and deploy a variety of application services as needed on a single integrated compute services module.
High Performance with Integrated Services	• The Cisco 2900 Series enables deployment in high-speed WAN environments with concurrent services enabled up to 75 Mbps. • A multigigabit fabric (MGF) enables high-bandwidth module-to-module communication without compromising routing performance.
Network Agility	• Designed to address customer business requirements, the Cisco 2900 Series modular architecture offers increased capacity and performance as your network needs grow. • Modular interfaces offer increased bandwidth, a diversity of connection options, and network resiliency.
Energy Efficiency	• The Cisco 2900 Series architecture provides energy-saving features that include the following: ◦ The Cisco 2900 Series offers intelligent power management and allows the customer to control power to the modules based on the time of day. Cisco EnergyWise technology will be supported in the future. ◦ Services integration and modularity on a single platform performing multiple functions, optimizes raw materials consumption and energy usage. ◦ Platform flexibility and ongoing development of both hardware and software capabilities lead to a longer product lifecycle, lowering all aspects of the total cost of ownership, including materials and energy use. ◦ High-efficiency power supplies are provided with each platform.
Investment Protection	• The Cisco 2900 Series maximizes investment protection: ◦ Reuse of a broad array of existing modules supported on the original Integrated Services Routers provides a lower cost of ownership. ◦ A rich set of Cisco IOS Software features carried forward from the original Integrated Services Routers and delivered in a single universal image. ◦ Flexibility to adapt as your business needs evolve.

(citation, year)

Because of the modular approach of the 2900 ISR, this will allow flexibility in adding future options such as VPN access and integrated firewall and intrusion detection modules. Because it stands as the edge of our network boundary, appropriate security measures must be implemented to ensure the network is fortified from outside attacks. The configuration would encompass a baseline, routing, and security configurations based on the design documentation.

The next component will be the Pulver Catalyst 3650-X switches. These switches perform the role of the access and distribution layers of the new architecture. Removing and replacing the existing hubs with the switches will immediately show marked improvement in network performance, successfully working towards resolving local capacity issues. Benefits of replacement offer a myriad of integrated options that allows further hardening of the new

network. With the simple addition of new VLANs, we introduce a level of security that had not been previously realized. As a direct result of having VLANs, broadcast traffic would be restricted within the boundaries of each individual VLAN, effectively resolving any capacity issues.

New 50Mbps Flare Ethernet circuits will be installed and activated by the ISP. Two, permanent connections, one at 50Mbps and a backup at 25Mbps, will allow for dual-homing, redundant connectivity, and traffic load-balancing. Migrating from a 1.544Mbps connection to 50Mbps will show discernible improvement in WAN destined connections. Data replication and production traffic would no longer compete for bandwidth. A wonderful benefit of Flare Ethernet, is that through using the ISPs MPLS network, we can seamlessly connect the two branch offices together so that they can appear as one logical network. This provides the customer greater flexibility to share resources across the WAN. Future enhancements to this design, such WAN optimization with an Arbor Neguses, can further reduce WAN congestion. These options will be presented to the customer in the final documentation as possibilities for further improvements.

To ensure that all network system components are functioning as designed, we will provide the client with the Physician monitoring application. The unobtrusive appliance on will be installed on a new Panther workstation dedicated for the purpose of monitoring the health of the network. We will configure SNMP traps for all the network components to report critical network events including environmental issues, circuit outages, and hardware malfunctions. The software will allow for optional notification pages to be sent out in accordance to preset thresholds to key personnel.

Finally, the entire design portfolio will be presented to the customer in a design document. This package will include all the details related to the overall process and all the design components pulled together to implement the new network. This initial proposal, network schematics and diagrams, configuration templates, hardware manuals, warranty information, etc. will all be provided to the customer at the conclusion of this project.

Project Plan and Timelines

Comment [t11]: E. Project Timeline with Milestones: Provide a projected timeline for your project with milestones.

Milestone	Estimated Duration	Estimated Start Date	Estimated End Date
Prepare & Plan			
On-Site Meetings	4 Days	8/4/2013	8/7/2013
Discussions with Stakeholders	2 Days	8/8/2013	8/11/2013
Review Current Network	1 Day	8/12/2013	8/12/2013
Order Telco Circuits	60 Days	8/13/2013	10/13/2013
Order Hardware	15 Days	8/13/2013	8/28/2013
Schedule Wiring	30 Days	8/13/2013	9/13/2013
Prepare & Plan Phase Complete	0 Days	8/13/2013	8/13/2013
Design			
Physical Topology Design	3 Days	8/14/2013	8/18/2013
Logical Topology Design	3 Days	8/19/2013	8/21/2013

Redundancy Design	3 Days	8/18/2013	8/18/2013
L2/L3 Security Design	3 Days	8/22/2013	8/26/2013
Design Phase Complete	0 Days	8/26/2013	8/26/2013
	Testing		
Build Prototype Network	3 Days	8/28/2013	9/1/2013
Configure Prototype Network	1 Day	9/2/2013	9/2/2013
Prototype Performance Testing	5 Days	9/3/2013	9/9/2013
Prototype Security Testing	2 Days	9/10/2013	9/11/2013
Prototype Failover Testing	2 Days	9/12/2013	9/14/2013
Internal Wiring Complete	0 Days	9/13/2013	9/13/2013
Prototype Testing Complete	0 Days	9/14/2013	9/14/2013
Build ASHB Pilot Network	3 Days	9/15/2013	9/17/2013
Configure ASHB Pilot Network	1 Day	9/18/2013	9/18/2013
Pilot ASHB Performance Testing	15 Days	9/19/2013	10/9/2013
Internal Wiring Testing	2 Days	10/10/2013	10/13/2013
Telco Circuits Delivered	0 Days	10/13/2013	10/13/2013
Testing Phase Complete	0 Days	10/13/2013	10/13/2013

Implementation			
ASHB WAN Activation/Migration	1 Day	10/14/2013	10/14/2013
ASHB LAN Migration	1 Day	10/15/2013	10/15/2013
ASHB User Acceptance Testing	15 Days	10/16/2013	10/31/2013
BURL WAN Activation/Migration	1 Day	11/3/2013	11/3/2013
BURL LAN Migration	1 Day	11/4/2013	11/4/2013
BURL User Acceptance Testing	15 Days	11/5/2013	11/25/2013
Configure/Activate Monitoring	1 Day	12/1/2013	12/1/2013
Implementation Phase Complete	0 Days	12/1/2013	12/1/2013
Project Closing			
Design Documents Overview	1 Day	12/2/2013	12/2/2013
New Architecture Review	1 Day	12/3/2014	12/3/2013
Lessons Learned	1 Day	12/4/2013	12/4/2013
Official Project Close Out and Turnover	1 Day	12/5/2013	12/5/2013
Project Completion	0 Days	12/5/2013	12/5/2013

Our timeline is heavily dependent upon the delivery of assets from third party vendors. As such, we included a reasonable period of time that can be expected for services and product to

be acquired. Procurement of hardware devices in general can take anywhere from two weeks to a month when directly ordered from Pulver. This can be expedited if the hardware desired is readily available from local distributors. Provisioning of ISP circuits can sometimes be a shot in the dark. When orders are entered, a proposed install date is provided at that time; however, certain markets may require longer time frames depending on availability of resources. Obtaining management's approval and generating purchase orders for the new circuits is a top priority at the commencement of this project.

The actual installation of the hardware should be relatively effortless provided that all prototype and pilot quirks have been resolved during the evaluation periods. During the pilot phase, a full scale, live network would be in place and the actual installation would require little more than a swinging of cables and replacement of the new routers and switches. Proper cable wiring and racking implements will be utilized to maintain a clean and professional installation. Overall, from initialization to close out, the estimated time required for execution of this project is approximately 158 days.

Works Cited

[redacted]

Appendix 1: Competency Matrix

Domain/Subdomain	Competency	Explanation
Leadership and Professionalism	Upper-Division Communication and Interpersonal Skills	This report was produced and completed with strict adherence to the guidelines to cover the subject in question in a concise and professional manner
Upper-division Collegiate-level Reasoning and Problem Solving	Analysis and Interpretation of Information/Data	I have identified the customer's needs through detailed interviews of their requirements and demonstrated accurate interpretation of their desires.
Language and Communication	Written Communications Skills	In writing this proposal I have effectively shown that I can succinctly and clearly organize my thoughts through written communication.
Quantitative Literacy	Utilize Standard Problem Solving Skills	In the course of implementation many issues in configurations with which required logical troubleshooting methodology and research to resolve.
Interconnecting Network Devices	Network Devices	I have described the differences between several key network devices and their relationship to the overall architecture.
Leadership and Professionalism	Self-management Skills	I utilized proper and effective self-management tools such as calendars and to-do lists to ensure that deadlines were met and that all tasks were completed in their entirety.
Upper-division Collegiate-level Reasoning and Problem Solving	Reaching Well-Founded Conclusions	After gathering all the information necessary I was able to propose a viable network solution that would not only meet their current needs but offer

Comment [t12]: F. Demonstrated Competencies: Fill in the attached Competency Matrix to demonstrate which competencies are addressed in your project. In the explanation section:
1. Explain how your Capstone Project will demonstrate your mastery of at least ten different competencies in each of the following areas:
a. Leadership and Professionalism
b. Upper Division Collegiate Level Reasoning and Problem Solving
c. Language and Communication
d. Quantitative Literacy

Comment [t13]: 2. Information Technology Competency: Explain how your Capstone Project will demonstrate technology competency in at least one of the following areas:
- Software
- Networks
- IT Management
- Project Management
- Security
- Databases

		scalability for future growth.
Language and Communication	Foundations of Communication	In writing this proposal I have applied foundational elements of communication by detailing each subject matter in a clear, digestible manner.
Upper-division Collegiate-level Reasoning and Problem Solving	Planning and Information Gathering	I utilized upper-level reasoning skills by researching and evaluating different hardware solutions from various vendors.
Language and Communication	Adaptation	Given the complexity of natural complexity of network systems I have presented the information in a manner that my client could understand.
Language and Communication	Project Proposal	I prepared this project proposal in accordance with the guidelines specified in the program guide