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Small Business Network Proposal for Sara Johnson

Executive Summary:

In any business or organization, a good base network design is vital to get work done efficiently, avoid cybersecurity issues, avoid crashes, and avoid hassles later when upgrading the network. For the small landscaping firm that is moving business to a new office location, the network requires a good foundation for your business needs and this proposal offers a solution. The business goal of this project is to create an efficient and capable network sufficient to handle multiple users. The network should include fast speeds, secure connections, reliable equipment, and a competent design. Moving into a new office location can be exhausting and confusing; with this new network that is being requested, it should exceed expectations to increase the employees' morale as well as help them get their work done in a timely fashion.

Starting with the Needs Analysis, this section discusses the high-level requirements given and how each need is met. From all of Sara Johnson's requests, the best option for the network is a Switch-Based Ethernet, containing network speeds of at least 75 Mbps. Thankfully, our proposed network has speeds up to 200/ 200 Mbps with the new broadband option of Verizon Fios. The network will have 4 employee PCs, 1 PC for Sara Johnson, 1 laser printer, 1 switch, and 1 router. For our logical topology, we will have a star, with the 6 devices connected to the switch, the switch connected to the router, and the router connected to the internet. As for software, the personal computers will come with Windows OS as well as Microsoft Office. Microsoft Office is extremely useful for business as it includes both Outlook and Excel. For the business' email needs, they can use Outlook which is a great email provider. As for database functions as well as customer data, customer history, etc., the business can use Excel. With great speeds from Fios, the Asus BRT-AC828 router, and the NETGEAR 8-Port Gigabit Ethernet Unmanaged Switch (GS108), these applications will be able to run smoothly with no issues. As far as more applications that should be considered, there are also more details discussed on Acuity Scheduling as well as NordVPN.

A diagram of the proposed logical network design can be found in the next section, Logical Network Design. In the diagram can be found the 6 devices, the switch, and the connection to the Internet. Once again, the logical topology of the network is a star, making it so that the switch is the central area for all devices. Thus, the network is easier to manage, and also it is more efficient. Both the LAN connection as well as the WAN connection to the internet are depicted and described further in the section.

As for Technology Design, the hardware that we chose includes the following: Asus BRT-AC828 router, NETGEAR 8-Port Gigabit Ethernet Unmanaged Switch (GS108), Dell, OptiPlex 7080, Dell E2318HN 23" Full HD 1920 x 1080 LCD/ LED Monitors, Logitech MK270 Wireless Keyboard And Mouse Combo For Windows, Canon imageCLASS MF743Cdw, and UbiGear 300ft Blue RJ45 Cat6 Ethernet LAN Network Internet Computer Solid Wire 23 AWG UTP Cable. These specific hardware options were chosen due to their price points, speeds, security, and overall business advantages.

Finally, for the Cost Assessment, the total initial fixed cost is going to be around $8,555. This total accounts for the hardware, peripherals, installation fees, as well as software fees. As for the ongoing operational fees for the next 3 years, the total comes out to around $8,002.44. This total includes maintenance, repairs, the Fios Internet Plan, as well as software monthly costs.

Needs Analysis:

As for needs and requirements, it is stated that Sara Johnson does not want a wireless network. Additionally, the company does not maintain a local server, meaning we must connect our devices to the internet. With that being said, we will be utilizing wired ethernet, specifically Switch-Based Ethernet, for our network. To operate this Switch-Based Ethernet, we will need a new broadband option, a router, and a switch; the 5 PCs and laser printer will be connected to a switch, the switch will be connected to a router, and the router will be connected to the ISP provided cable to connect to the Internet. To choose our hardware, we need to calculate the necessary speeds that our internet should reach. According to an article done by *CenturyLink*, to find out the speed at which our network needs to operate we must multiply the number of employees by 10-15 Mbps. We multiply by 10-15 Mbps because that speed encompasses downloading videos, handling emails, sharing large files, and more (Century Link, 2022, para. 7). We have 5 overall employees on the network simultaneously, meaning that we need network speeds up to 75 Mbps.

First of all, it is known that we need to find a new broadband option. For our broadband and to connect the office to the internet, a great option would be a Verizon Fios Internet plan. According to an article on *Business.org*, Verizon has the "best combination of business internet speeds, reliability, and support," (Okoren, 2022, pg. 1); Verizon has great customer support, great prices, and fast speeds. Moreover, with the cheapest plan offered, Verizon Fios has a 99.99% network reliability, 200 Mbps download speeds, 200 Mbps upload speeds, and they can also host computer servers (Verizon, 2022, pg. 1). With the 200/200 Mbps speeds, this is well enough over 75 Mbps, which is the speed that our network required.

As for routers, it is important to purchase one that is protective of our network, cost-efficient, and fast. In the office, there are 4 full-time employees, 4 desktop PCs for those employees, 1 desktop PC for Sara Johnson, and 1 networked laser printer. A router that would be great for the office would be an Asus BRT-AC828 router. According to an article published on *TechRadar,* the router features "theoretical speeds of up to 2.6 Gbps, hardware security, Dual WAN, RADIUS support, 8 Gigabit Ethernet ports, [and] impressive expansion capabilities," (Probst, 2022, pg. 1). With the many included security features as well as the fast speeds that it provides, this makes the perfect router for the network that we are trying to build.

To go along with our router, we also need a switch to improve performance. With switches, "every computer can transmit at the same time, resulting in much faster performance," (FitzGerald, 2021, pg. 232). For the new office, the switch that we purchase must have at least 6 ports, be well-built, and be fast enough for our network (at least 75 Mbps). The NETGEAR 8-Port Gigabit Ethernet Unmanaged Switch (GS108) would be a great option for a switch. According to another article published on *TechRadar*, the switch features 8 ports, an "internet splitter, [a] sturdy metal case, easy monitoring, gigabit ethernet, [and a] lifetime warranty," (Athow, 2021, pg. 1). This switch would be great for us as it features the desirable number of ports, it is well-build, it is fast, and it also has a lifetime warranty in case anything happens to it.

With the Verizon Fios Internet plan that we plan to purchase, we can connect the office to the Internet by plugging in the cable that Verizon provides into our Asus BRT-AC828 router. To connect the employee computers, Sara Johnson's computer, and the laser printer to the Internet, we can connect them to the NETGEAR switch with Ethernet cables. In addition, the switch would also be connected to the router. For the devices and switch, they should have a star topology, both logically and physically. Star

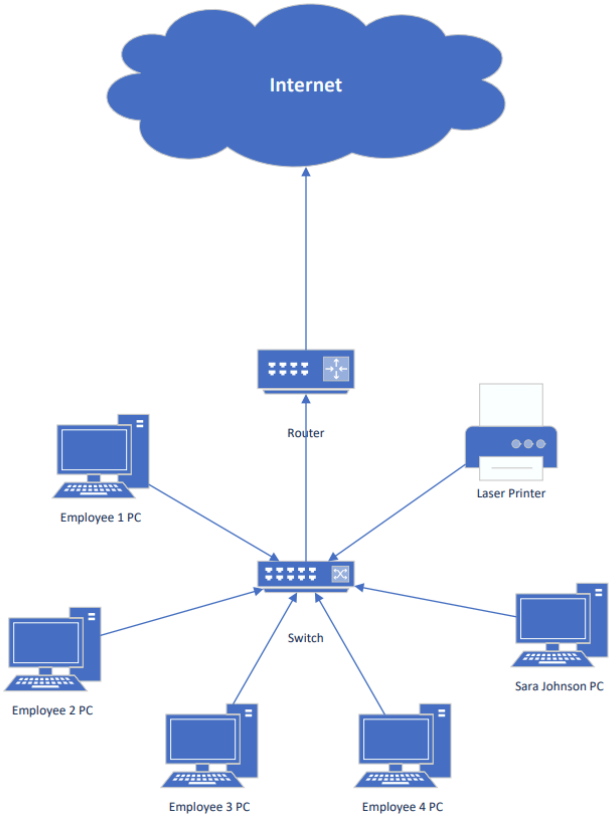
topology should be used as it “is easy to manage because the central computer receives and routes all messages in the network,” (FitzGerald, 2021, pg. 298). With the star topology, computers are also able to transmit at the same time which leads to better performance.

Regarding software, it is stated that each PC runs Windows OS and has Microsoft Office. Furthermore, employees need to access a scheduling system as well as their emails over the Web. The broadband option, router, and switch that we selected will allow employees to access both things through the web. Either through Microsoft Edge or any other free browser, the scheduling system as well as emails will be able to be handled. If specific application recommendations are needed for both scheduling as well as emails, Acuity Scheduling and Microsoft Outlook are great options. Acuity Scheduling is a tool that helps organize schedules, plan meetings and appointments, and sort client/ work partner information (Acuity Scheduling, 2022, pg. 1). With Acuity Scheduling, planning landscaping jobs will be much easier and neater. On the other hand, Microsoft Outlook comes with Microsoft Office and is a great tool for emails, especially for businesses. Outlook will allow for fast, reliable emailing as well as provide employees with uniform email end addresses. Other than scheduling and emails, the landscaping company will also need to keep track of payments, customer data, and customer history. To track all of those, the office can use Microsoft Excel, Microsoft’s spreadsheet software. Excel is a great option, as it can sort through data, create charts, and much more. As mentioned earlier, our network speeds need to be up to at least 75 Mbps. Especially with the specific applications, it is key that we meet that requirement. However, our broadband from Verizon can run up to 200 Mbps for downloading and uploading, meaning that we have more than enough speed to run all of the applications with 5 simultaneous users.

More software should be installed to protect both the PCs as well as the network overall. On each of the 5 PCs in the office, they will each include NordVPN. NordVPN is a software that helps protect against malware, increases network performance, prevents data leaks, and overall increases security (NordVPN, 2022, pg. 1). With this software, the network as well as the computers will be further protected.

Logical Network Design:

The logical network design describes how our system will function and operate. The network design is key; if it is off or does not meet the necessary standards, then the company will suffer. As mentioned in the Needs Analysis, we will be using a Switch-Based Ethernet with a star topology. Provided below is a proposed logical network diagram of the network:



The logical network diagram includes the 4 employee PCs, Sara Johnson's PC, the laser printer, the switch, the router, and a connection to the Internet. The PCs, laser printer, switch, and router all make up the LAN, or Local Area Network; these are the things that are inside of the physical office and combine to create the network. As seen above, the PCs and laser printer are all individually connected to the switch through Ethernet cables to form a star topology. With the star topology, the devices only must communicate with one central area, making the network easy to manage. In addition, the star topology allows the devices to communicate with the switch simultaneously resulting in a fast network. Next, the switch is then connected to the router through an Ethernet cable, which "enables computers on this network to communicate with computers on the same network or on other networks," (FitzGerald, 2021, pg. 25).

The office's LAN will connect to the Internet through a wide-area network (or WAN) connection. To do so, the Internet Service Provider (ISP) provided cable is plugged into our router, giving us access to the Internet. In our case, the ISP cable is set up and given to us by Verizon through the purchase of our broadband.

Technology Design:

When creating the technology design, all hardware components should be specified and accounted for. The hardware pieces included in this network are the router, switch, PCs, and laser printer. For the router, as mentioned in the Needs Analysis, we are opting for the Asus BRT-AC828 router. The gaming company's only router was made incredibly well with "theoretical speeds of up to 2.6 Gbps, hardware security, Dual WAN, RADIUS support, 8 Gigabit Ethernet ports, [and] impressive expansion

capabilities," (Probst, 2022, pg. 1). With all these included features, this router is an excellent choice for our network and will connect our devices to the Internet easily. Also, this router contains repeater functionality built into it, meaning there is no need to purchase another repeater. The fast speeds of the router are excellent, with us not having to worry if it can keep up. One key thing to take away from this router is its security features which include "block[ing] access to malicious websites, infection detection and blocking, [and] protection against all common internet-based attacks," (Asus, 2022, pg. 1). The switch that we recommend was also mentioned in the Needs Analysis, which is the NETGEAR 8-Port Gigabit Ethernet Unmanaged Switch (GS108). As previously stated, this switch has 8 ports, an "internet splitter, [a] sturdy metal case, easy monitoring, gigabit ethernet, [and a] lifetime warranty," (Athow, 2021, pg. 1). Not only does the switch have more than enough ports needed, but it is also fast, easy to manage, well-built, and includes a lifetime warranty. As for the PCs, it is important to get one with a good CPU, a decent amount of storage, and Ethernet connectivity. With a good CPU, good RAM, and a decent amount of storage, this makes it so that the computer is reliable and efficient. According to an article published on *DigitalTrends*, the Dell OptiPlex 7080 looks like an amazing option. For specifications the CPU is a 10^{th}-gen Intel Core i5-10500 processor, the RAM is 8GB, the storage is 500GB HDD, and it also includes Gigabit Ethernet (Nguyen, 2021, pg. 1). These amazing specifications come at a great price as they are more than worthy of our network. The 8BG of RAM and CPU are huge highlights, making it so our PCs function incredibly fast. The 500 GB HDD of storage is a huge plus as well, allowing us to store lots of files as well as keep our PC up and running well for a while. However, these 5 PCs that we plan to purchase do not come with peripherals, meaning we must buy them separately. For the monitors, we will purchase 5 Dell E2318HN 23" Full HD 1920 x 1080 LCD/ LED Monitors. These monitors are of good quality, are 1920 x 1080, and connect using HDMI. As for the keyboard and mouse, we will buy the Logitech MK270 Wireless Keyboard And Mouse Combo For Windows. This combination of keyboard and mouse provides comfort, is highly durable, is easy to use, and has a long battery life (Newegg, 2022, pg. 1). Lastly, for the laser printer, we will purchase the Canon imageCLASS MF743Cdw. According to an article on *RTINGS.com*, this Canon laser printer has many connectivity options, produces high-quality scans, has high-quality prints, and prints fast (Lim, 2022, para. 1). With our network, it is able to connect through LAN and it is also of great quality, making it an amazing fit. For the Ethernet cables that will connect everything, we will use UbiGear 300ft Blue RJ45 Cat6 Ethernet LAN Network Internet Computer Solid Wire 23 AWG UTP Cable found on Amazon. With that being said, to reiterate the connections, the PCs and laser printer are connected to the switch, the switch is connected to the router, and the router is connected to the internet. Thus, everything is connected to the Internet and ready to operate.

Cost Assessment:

With many moving pieces, this project can be considered quite expensive. As for initial fixed costs, this includes the broadband plan, the router, the switch, the 5 PCs, the 5 monitors, the 5 mouse and keyboard combinations, the laser printer, the Ethernet cable, and Microsoft Office. As for ongoing operational costs, this includes the broadband plan, general network maintenance and repair, the Acuity Scheduling software, and the NordVPN software. All the costs, both initial and ongoing, are summarized neatly below:

Initial Fixed Costs: Hardware		**Total: $6,605**
Fios Business Internet Plan (200/200 Mbps) *[Activation Fee]*	$49	
Asus BRT-AC828 router	$350	
NETGEAR 8-Port Gigabit Ethernet Unmanaged Switch (GS108)	$34	

Dell OptiPlex 7080	$4,855 ($971 each)	
Dell E2318HN 23” Full HD 1920 x 1080 LCD/ LED Monitors	$550 ($110 each)	
Logitech MK270 Wireless Keyboard And Mouse Combo For Windows	$135 ($27 each)	
Canon imageCLASS MF743Cdw	$600	
UbiGear 300ft Blue RJ45 Cat6 Ethernet LAN Network Internet Computer Solid Wire 23 AWG UTP Cable	$32	
Initial Fixed Costs: Hardware Installation Fees		**Total: $1,800**
Fios Business Internet Plan (200/200 Mbps)	$300 (1 hour)	
Router, Switch, PC, Ethernet, and Printer Installation Fee	$ 1,500 (5 hours)	
Initial Fixed Costs: Software Fees		**Total: $150**
Microsoft Office *(Contains Outlook and Excel)*	$150	
Ongoing Operational Costs: Hardware		**Total for 3 Years: $6,984 ($2,328/ year)**
Fios Business Internet Plan (200/200 Mbps)	$828/ year	
Router, Switch, PC, Ethernet Maintenance / Repair	$1,500/ year	
Ongoing Operation Costs: Software		**Total for 3 Years: $1,018.44 ($339.48/ year)**
Acuity Scheduling *(Scheduling Software)*	$23/ month	
NordVPN *(Cybersecurity Software)*	$5.29/ month	

For the Fios Business Internet Plan, it is stated 3 times on the cost list: one for the activation fee, one for the installation fee, and one for the monthly ongoing fee to keep the internet going. The software fees for both Acuity Scheduling and NordVPN are both ongoing as well sitting at $23/month and $5.29/ month respectively. As for the PCs, monitors, and keyboards and mouses, those prices are each multiplied by 5 due to the quantity needed for the network. As you can see pictured above, some of the main costs go into installation and maintenance fees. Though it is costly, this is done to pay for labor and get/keep our network up and running.

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