**Network Design Project**

Harrison Pierce

Framingham State University

Contents

[Introduction 2](#_Toc531640684)

[Corporate Business description 2](#_Toc531640685)

[Floor space size and layout 3](#_Toc531640686)

[Floor Map 4](#_Toc531640687)

[Hardware Options and Vendor Choices 5](#_Toc531640688)

[Cables 5](#_Toc531640689)

[Switches 6](#_Toc531640690)

[Routers 6](#_Toc531640691)

[Servers 7](#_Toc531640692)

[Laptops 7](#_Toc531640693)

[Installation Labor 7](#_Toc531640694)

[ISP/Telephone cost 8](#_Toc531640695)

[Overall Cost 8](#_Toc531640696)

[References 10](#_Toc531640697)

# Introduction

HP enterprises Inc. is a new company selling goods from their main facilities in Framingham, Massachusetts. They have recently finished designing the layout and map of the business’s network. Three venders were identified and reviewed to find the most suitable to supply materials for the project. Totals of all equipment has been compiled and added to installation pricing to fine the overall total.

# Corporate Business description

The name of the corporation evaluated is HP enterprises Inc. from Framingham Massachusetts. They specialize in the sale of hats with customer specified designs. Manufacturing occurs in a warehouse behind the main office area. There are 20 employees total consisting of secretary, president, CFO, 4 engineers, 4 salesman, 4 marketers, 5 manufacturers, and 1 shipping and handling processer. Each employee is given a work laptop for work use. Every employee has an office which is wired for LAN and wireless use via RJ-45 connection and Wi-Fi technology. The secretary has their own land line phone for business use at the front desk. The company prioritizes a fast connection for efficiency of the business and uses a 300Mbps upload and download speed from Charter which also provides land line service. The chosen LAN cables are fast, reliable and are rated to last a long period of time while not breaking the bank. Most products have been chosen with a financial consciousness in mind. Weighing the pros and cons and deciding based on what is truly important to the company while cutting what is not important.

# Floor space size and layout

The main office business building is roughly a 80ft by 100ft rectangle. There are 9 rooms and a hallway spanning the building. Each room is roughly the same size and features 2 LAN ports in the wall. There is one main Router base and 3 router nodes spread around the building, ensuring proper coverage for all employees and potential customers. The ISP installed a network cable entering from the street and into the network room where the modem received the signal and sends it to the 8-port switch. One signal is then sent to each of 3 server computers. Another signal is sent from the switch to the main router base and wirelessly transmitted throughout the building via its 3 separate access nodes.

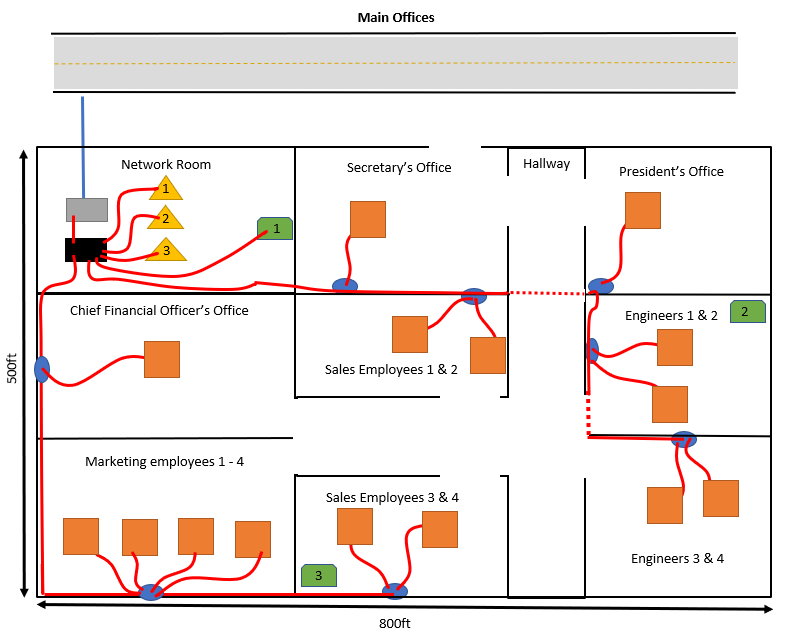
Upon initial entry via the front entrance, employees and visitors be in the front office where the secretary’s desk is to greet them. Looking left there is the door to the hallway where all the other offices branch from. The first office is the President’s. Continuing down the hall are the entrances to offices shared by engineers 1 and 2 and the second office shared by engineers 3 and 4. At the very end of the first hallway is the rear exit which leads to the second part of the business, manufacturing. This will be covered at a later point. Rewinding, about halfway down the hall and across from entrances to the engineer’s rooms, is the second hallway entrance. This hallway is perpendicular to the first and leads to offices for sales. On the right is the office for sales employees 1 and 2 and on the right is the office for sales employees 3 and 4. Finally, at the end of hallway 2 is the CFO’s office on the right and the marketing office on the left. Flanking the CFO’s office is the network room, only accessible through the rear of the president’s office.

The manufacturing building resides to the right of the office building when looking view of the street. It has a total of 6 offices and 1 hallway spanning the length of the building. 5 offices consist of private rooms for manufacturing employees and 1 room for shipping and handling. Every room has a LAN outlet on the wall and allows every employee to plug directly into their laptop. The same wireless networking router is used in the manufacturing building as in the main office building. Both buildings are 8000 square feet, the maximum range allowed for the Netgear Orbi router. [9]

The initial LAN cable spans from the networking room in the main office building. It starts at the central switch next to the modem and runs a few feet to the manufacturing area right next door. It then enters the building and connects to a switch which distributes the signal to the second Orbi router and all the rooms for a wired LAN connection.

# Floor Map

A screenshot of a cell phone

Description automatically generated

4

80ft

100ft

A screenshot of a cell phone

Description automatically generated

1

2

3

4

LAN from network room

# Hardware Options and Vendor Choices

## Cables

**Cable Wholesale outdoor rated CAT6 1000ft($188)**

High performance cable, at a high price. This cable from CableWholesale comes in an easy to use spool and is rated to withstand the outdoor temperatures. This however is likely unnecessary since cabling will be indoors. [1]

**Vertex Cables Cat6 Plenum CMP rated 1000ft($182)**

This unshielded cable comes at a similar price to that from Cable wholesale, however is performance tested and coated with a Plenum Jacket. Though the price is also not cheap, the increased performance is worth the extra dollars for a more efficient workplace. This is the best option for the company. [2]

**Cable Matters In-Wall rated Cat6 1000ft($149)**

The in-wall rated cat6 from Cable Matters is a solid offer at its less expensive price. However it is not specially coated to withstand the test of time. Though it may save the company in the short run, it is significantly more expensive to later have to teal apart a wall and find a broken wire somewhere. [3]

## Switches

**Netgear 16 Port Gigabit unmanaged switch ($99)**

The first option comes from netgear and features full 1000Mbps transfer speeds and plenty of ports for future expansion if needed. The switch also sports LED indicator lights for easy monitoring. Auto MDI/MDIX removes the need for bv crossover cables. [4]

**TP-Link 5 port Gigabit Switch ($34)**

This switch features the same speeds as the netgear but in a sleeker, metal design. Port based priority is also included to ensure lag free voice and video. Though this offers more overall features than the netgear, it also does not have enough ports to satisfy the amount required. [5]

**Linksys 8 port Gigabit Ethernet switch ($49)**

Included with this model is the same transfer speeds as other models, LED indicator lights, QoS management and has the right amount of ports for possible future expansion but not at a premium price. This is the right model for the business. [6]

## Routers

**Google WIFI mesh system 3 Pack ($299)**

This wireless router includes multiple access points one package. Speed on each node is limited to 1200Mbps and includes beamforming technology. The maximum square footage is 4500ft. Each node includes 1 ethernet out jack. It is also backwards compatible with 802.11a/b/g/n. All of the settings are manageable via an easy to use mobile application. [7]

**Linksys Velop mesh Wi-Fi system 3 pack ($499)**

The flagship Velop model from Linksys offers 6000 square feet of coverage, with speeds of up to 2200Mbps per node. It is backwards compatible with all 802.11 versions and also features beamforming technology. There are 2 ethernet out ports on each node. [8]

**Netgear Orbi mesh system 4 pack (469.99)**

The highest end Orbi model includes a transfer speed of 2200Mbps, 4 nodes unlike the 3 from competitors at a similar price point and can cover up to 8000 square feet. Each node has a sleek design and is ready right out of the box. There are 2 ethernet ports on every node. For the price this is the most logical choice for the business. [9]

## Servers

**Dell PowerEdge T30($629)**

This server computer includes all the necessities for a small business. With a compact size yet powerful specs, it can be perfect for every office. There are 8gb of internal memory, 1tb hard drive, and an Intel Xenon E3-1225 processer ensuring speedy performance and plenty of room to store data. The computer is also upgradable for future additions of storage or ram. [10]

**Netgear ReadyNAS RN424E4($1069)**

One of netgear’s middle of the pack server computers it includes 16tbs of high-performance storage, a 1.5ghz dual core processor and 2 gigabytes of ram. Though the processing speed of this machine is not equal to that of the Dell, its far superior amount of storage allows for significantly larger amounts of data to be stored on the device. Though it comes at a higher price tag. [11]

**HPE ProLiant DL20 Gen9 ($633)**

The ProLiant DL20 from HP includes a Xenon E3 processor and dedicated NVIDIA graphics for intense processing and focused computation. The computer also includes 8gbs of Ram and a 1tb hard drive. Though it is offered at a lesser price than some of its competitors, there is a limited amount of storage space available for the user. [12]

## Laptops

**Lenovo ThinkPad E580 ($899)**

Lenovo’s offering brings an Intel i5, 8gb of Memory, a 256gb SSD, and a 15.6-inch screen. This is a decent option for the price and would give employees a decent amount of power and processing speed to complete their task. The SSD keeps things running smoothly though does not offer a very large amount of overall storage when compared to some other models. [13]

**Dell Inspiron 2 15.6 ($979)**

Dell’s laptop includes a Intel i7 processer, 16gb of memory, a 512gb SSD, and a 2 in 1 touch screen design at 15.6 inches. The device can be used like a tablet when the screen is flipped, putting it into tablet mode. Though the device is faster than its competitor, its price is increased somewhat significantly and includes unnecessary features like the tablet mode. [14]

**HP Envy 2 in 1 15.6 ($879)**

HP brings the best value to the table. The laptop packs a processor comparable to the i7 powerhouse found in the Dell, a 256gb SSD, and 8gb of memory. However, unlike the other two, this device features dedicated graphics, this making it significantly better at 3D rendering and complex math. At a price lower than both other options, it is the best value and option for the company. [15]

## Installation Labor

According to average costs in the Framingham area, the total net cost of setting up the network for use and connecting 20 devices, it would cost about $1282 on the low side and $1554 on the high side. [16]

## ISP/Telephone cost

**Verizon Business**

Verizon offers a decent value with their business plans available. At a total price of $189.99, per month, Verizon bundles 300/300mbps for up to 20 devices, with voice and a $200 visa gift card credit. [17]

**Charter Spectrum**

The business plan offered by Charter Spectrum includes 300/300mbps with voice included. The total price is $120 per month. Though Verizon offers a $200 visa credit with signing up, the $70 saved over paying $190 for Verizon would make up the difference in only a few months, making Spectrum the better value. This is overall the best choice for the business in the long run. [18]

**Comcast Business**

Comcast’s offer for equal speeds to charter and Verizon is at a much greater price. Similarly, voice is included with the package, but seems to lack any incentive over the competition other than an instant cash back of $300. The total is $229 per month, for the same 300 up and down which over the course of 1 year would already eclipse the price of Verizon and charter when factoring for the cash back bonus for signing up. [19]

# Overall Cost

**Cables**

Vertex Cables Cat6 Plenum CMP rated 1000ft($182) [2]

~1,500ft needed

2 \* $182 = …………………………………………………………………..………………$364

**Switches**

Linksys 8 port Gigabit Ethernet switch ($49) [6]

2 needed

2 \* $49 = ……………………………………………………………………………………..$99

**Routers**

Netgear Orbi mesh system 4 pack (469.99) [9]

2 needed

2 \* $469 = ………………………………………………………………………………….. $938

**Servers**

Netgear ReadyNAS RN424E4($1069) [11]

3 needed

3 \* $1069 = ………………………………………………………………………………..$3,207

**Laptops**

HP Envy 2 in 1 15.6 ($879) [15]

1 laptop/ employee = 20 laptops + 2 backups = 22 total

22 \* $879 = ………………………………………………………………………………..$19,338

**Installation**

Labor high: $1,554 Labor low: $1,282 [16]

(1554 + 1282) / 2

Labor average Total.………………………………………………………………………..$1,418

**ISP/Telephone**

Charter Spectrum $120/mo [18]

12 \* $120 = 1 year of service………………………………...……………………………$1,440

**TOTAL COST…………………………………………………………………………...$26,804**

Conclusion

HP enterprises Inc. is a new company selling goods from their main facilities in Framingham, Massachusetts. Totals of all equipment has been compiled and added to installation pricing to fine the overall total. After evaluating the company outline and plan, a total cost of $26,804 was found to run set up the business and pay for 1 year of internet and telephone service. Three venders were identified and reviewed to find the most suitable to supply materials for the project.

# References

[1] <https://www.cablewholesale.com/products/network-phone/cat-6-cable-bulk/product-10x8-722nh.php>

[2] https://www.vertexcables.com/1000ft-cat6-plenum-cmp-ethernet-cable.html

[3] https://www.amazon.com/Listed-Cable-Matters-Copper-Ethernet/dp/B0049L0V46/ref=sr\_1\_7?ie=UTF8&qid=1543635105&sr=8-7&keywords=cat6%2Bethernet%2Bcable%2B1000ft&th=1

[4] <https://www.bestbuy.com/site/netgear-16-port-10-100-1000-mbps-gigabit-unmanaged-switch-blue/8363086.p?skuId=8363086>

[5] <https://www.bestbuy.com/site/tp-link-5-port-10-100-1000-mbps-gigabit-smart-ethernet-metal-switch-gray/2080346.p?skuId=2080346>

[6] <https://www.bestbuy.com/site/linksys-8-port-gigabit-ethernet-switch-black/4781602.p?skuId=4781602>

[7] https://www.bestbuy.com/site/google-google-wifi-ac1200-dual-band-mesh-wi-fi-system-3-pack-white/5706130.p?skuId=5706130

[8] https://www.bestbuy.com/site/linksys-velop-tri-band-mesh-wi-fi-system-3-pack-white/5709451.p?skuId=5709451

[9] <https://www.bestbuy.com/site/netgear-orbi-ac2200-tri-band-mesh-wi-fi-system-4-pack-white/6106001.p?skuId=6106001>

[10] <https://www.dell.com/en-us/work/shop/cty/pdp/spd/poweredge-t30/pet30_12084_3?CID=314684&st=dell%2Bpoweredge%2Bt30&VEN1=x3xIPQ8K,74079690371664,901qz26673,c,&VEN2=be,dell%2Bpoweredge%2Bt30&LID=5957865&dgc=st&dgseg=cbg&acd=123092153372795930&VEN3=810604651711623635>

[11] <https://www.amazon.com/dp/B0711G38R8?tag=price17562-20&ascsubtag=wtbs_5c01f23b83c5b71c0881ea20>

[12] <https://buy.hpe.com/pdp?catId=15351&reqCatId=1008556817&catlevelmulti=15351_3328412_7486465&prodNum=871428-B21&country=US&locale=en&reseller=PCM&jumpid=ps_jxskgyzrw5_aid-510380402&msclkid=4051b1d9540c131bd416edd8a0d59335&gclid=COCM8dLN_d4CFYHBswodjcsEaQ&gclsrc=ds>

[13] <https://www.bestbuy.com/site/lenovo-thinkpad-e580-15-6-laptop-intel-core-i5-8gb-memory-256gb-solid-state-drive-black-black/6239908.p?skuId=6239908>

[14] <https://www.bestbuy.com/site/dell-inspiron-2-in-1-15-6-touch-screen-laptop-intel-core-i7-16gb-memory-512gb-solid-state-drive-theoretical-gray/6162024.p?skuId=6162024>

[15] <https://www.bestbuy.com/site/hp-envy-2-in-1-15-6-touch-screen-laptop-amd-ryzen-7-8gb-memory-amd-radeon-rx-vega-10-256gb-solid-state-drive-hp-finish-in-dark-ash/6237336.p?skuId=6237336>

[16] <https://homewyse.com/services/cost_to_install_computer_network_wiring.html>

[17] <https://go.verizon.com/lp/business/bundles-lf?kbid=99530&src=ppc&msclkid=5f33fd298c2f11e9c851a12808e08a58&utm_source=bing&utm_medium=cpc&utm_campaign=%5BB%5D%5BVZNB%5D%20VZNB%20Plans%20-%20%5BExact%5D&utm_term=%5Bverizon%20business%20plans%5D&utm_content=%5Bvznb%20plans%5D>

[18] <https://business.spectrum.com/bundles.html>

[19] <https://business.comcast.com/shop/offers>