CNT 4603: System Administration
Spring 2022

Project Two

Instructor : Dr. Mark Llewellyn ~~HEC 236, 407-823-2790~~
Email: mark.llewellyn@ucf.edu
Office Hours via Zoom: M: 12:30-1:30 pm T & Th: 4:30-5:30pm,
W: 3:30-4:20pm
Office Hours Zoom Details: Meeting ID: 965 8742 9814
Passcode: 153466
Q&A Sessions via Zoom: Meeting ID: 981 7462 2262
Passcode: 221687

Department of Computer Science
University of Central Florida

Project Two: Overview

- **Title:** "Project Two: Virtualization Cost/Benefit Analysis"
- **Points:** 100 points
- **Due Date:** **Sunday February 20, 2022 by 11:59 pm (WebCourses time)**

- **Objectives:**
  1. To practice conducting a financial feasibility cost benefit analysis for a server virtualization project.
  2. To prepare an executive summary of the feasibility study.

Project Two: Overview

- What you are going to do in this project is pretend that you are the system administrator for an organization that is attempting to determine if virtualization of its server infrastructure would be beneficial to the organization from a financial perspective.
- As the system administrator you are in charge of conducting the cost/benefit analysis for the proposed virtualization project.
- This will include creating financial spreadsheets using a 5 year projection and writing a brief report summarizing your findings.

Project Two: Overview

- As explained in the notes, a feasibility analysis such as this requires that you be able to compare the way the organization is currently operating with the proposed changes to the operation.
- The first step in the analysis is to completely determine the costs associated with the current operational technique.
- For this project, we will restrict the analysis to only a server virtualization project. This means that we need to develop a complete cost picture of the current server infrastructure to compare to a proposed server infrastructure cost.
- The next few pages describe the current infrastructure of the organization and the proposed virtualization project. Let's call the organization the HostNickel (we're not as big as HostDime!).

Project Two: The Current Scenario

- Currently HostNickel is running 2000 physical servers in its data center which support various applications and several different operating systems.
- These servers are configured into four different groups:
  - Group 1 consists of 750 mission critical servers. Group 1 servers consume 3500W of power each at full load (100% CPU utilization). The Group 1 servers average load is 15%.
  - Group 2 consists of 800 mission critical servers. Group 2 servers consume 4500W of power each at full load (100% CPU utilization). The Group 2 servers average load is 22%.
  - Group 3 consists of 75 non-mission critical in-house application and file servers, each of which consumes 2800W of power at full load. The servers in this group run with an average load of 10%
  - Group 4 consists of a pool of 375 redundant servers utilized as backup servers. The Group 4 servers are split into two subgroups, call them Group 4A with 200 servers and Group 4B with 175 servers. Group 4A servers draw 3800W at full load and are used as backups for Group 1 and Group 2 servers. The Group 4B servers draw 3300W at full load and are used as backups for primarily Group 1 and Group 3 servers. Group 4A and 4B servers run at average 1% load.

Project Two: The Current Scenario

- **Project Hint #1:**

- The power consumed by a server is measured in Watts. Power companies charge for power based on kWH (kilowatt-Hours). The Group 1 servers consume 3500W of power at full load. However, they only average a 15% load, so what they actually consume, on average, is 3500W x 0.15 = 525W. A device that consumes 1000W = 1kW for 1 hour will use 1kWH of power. Thus, the Group 1 servers are consuming 525W = 0.525kW, so in 1 hour they will use 0.525kWH of power. Servers run 24/7 so in 1 day, one Group 1 server will use 0.525kWH x 24hr = 12.6kWH of power. There are 750 servers in Group 1, so collectively they will consume 750 x 12.6kWH = 9450kWH of power in 1 day. Our assumption (see page 16) is that the power company is charging 13 cents/kwH, so, running all Group 1 servers for 1 day will cost: 9450kWH x 0.13$/kWH = $1228.50. For year one, the cost to power Group 1 servers will be $1228.50 x 365 = $448,402.50.

Project Two: The Current Scenario

- The maintenance contracts on the current physical servers are as follows:
  - Group 1 (3500W) servers: $1500.00/server/year
  - Group 2 (4500W) servers: $1750.00/server/year
  - Group 3 (2800W) servers: $1000.00/server/year
  - Group 4A (3800W) servers: $1100.00/server/year
  - Group 4B (3300W) servers: $750.00/server/year
- Assume that server maintenance costs will increase 3%/year over the duration of the study for all server maintenance agreements.

Project Two: The Current Scenario

- **Project Hint #2:** Use a fine grain breakdown of variables in your spreadsheet – do not "lump together" various values.

B	C	D
	Variables Used In This Spreadsheet	
e	Variable Name	Variable Description
	numServersGroup1	GroupA consists of this many 3200W servers
	numServersGroup2	Group 2 consists of this many 3800W servers
	numServersGroup3	Group 3 consists of this many 2800W servers
	numServersGroup4A	Group 4A consists of this many 3800W servers - backup servers
	numServersGroup4B	Group 4B consists of this many 2800W servers - backup servers
	serverPowerGroup1	power in watts of the servers in group 1
	serverPowerGroup2	power in watts of the servers in group 2
	serverPowerGroup3	power in watts of the servers in group 3
	serverPowerGroup4A	power in watts of the servers in group 4A
	serverPowerGroup4B	
	serverLoadGroup1	
	serverLoadGroup2	
	serverLoadGroup3	
	serverLoadGroup4A	
	serverLoadGroup4B	
	maintenanceCostYear1Group1	
	maintenanceCostYear1Group2	
	maintenanceCostYear1Group3	
	maintenanceCostYear1Group4A	
	maintenanceCostYear1Group4B	

Do it this way!

Do not do it this way!

B	C	D
	Variables Used In This Spreadsheet	
Value	Variable Name	Variable Description
	numServers	total number of servers
	serverPower	total server power
	serverLoad	average load of the servers
	maintenanceCostYear1	cost of maintenance contract year 1

Project Two: The Current Scenario

- Server administration efforts also vary across the server groups as follows:
  - Group 1 (3500W) servers: 2.5 administrative weeks/server/year
  - Group 2 (4500W) servers: 3.5 administrative weeks/server/year
  - Group 3 (2800W) servers: 1.5 administrative weeks/server/year
  - Group 4A (3800W) servers: 2 administrative weeks/server/year
  - Group 4B (3300W) servers: 1 administrative week/server/year
- Administrative costs are currently $75/administrative hour. Assume that administrative costs will increase at the rate of 2%/year over the duration of the study.
- An administrative day is 10 hours long. An administrative week is 7 days long. A server day is 24 hours long.

Project Two: The Current Scenario

- Server backup efforts also vary across the server groups as follows:
  - Group 1 (3500W) servers: these servers are backed-up nightly and require 45 minutes per server.
  - Group 2 (4500W) servers: these servers are backed-up nightly and require 1 hour per server.
  - Group 3 (2800W) servers: these servers are backed-up weekly and require 2 hours and 15 minutes per server.
  - Group 4A (3800W) servers: these servers are backed-up weekly and require 90 minutes per server.
  - Group 4B (3300W) servers: these servers are backed-up every other week and require 2 hours per server.

Project Two: The Current Scenario

- **Project Hint #3:**

- Be careful with units and time. Some servers are backed-up nightly, others weekly or every other week. Example – Group 1 servers are backed-up nightly requiring 45 minutes/server. Thus, each server in Group 1 requires 365 x 0.75 hours/year of administrative time for backups. Since you are given the time requirement in minutes and administrative time is based on hours, convert backup effort into hours, so 45 minutes = 0.75 hours. Thus, one server in Group 1 requires a total of 273.75 hours of backup time in 1 year. There are 750 servers in Group 1 so the total time required for backups is 750 x 273.75 = 205,312.5 hours. Administrators are paid at the rate of $75.00/hour, so the cost of backing up Group 1 servers for year 1 of the study is 205,312.5 hrs x $75.00/hr = $15,398,437.50.

- Servers that are backed-up weekly require only 52 backups/year. Similarly, those which are backed-up every other week will require only 26 backups/year.

Project Two: The Current Scenario

- HostNickel currently employs an external security firm to run routine security audits on the mission critical servers (Groups 1 and 2). This occurs once a month and is a flat charge of $4500.00. Current contract with this firm guarantees this price through the duration of this study.

- HostNickel currently employs a data storage company to maintain archival backup copies of server backups. The charge for this service is billed monthly and is based on the data volume stored each month. The bill last month was $6500.00. Based on the data volume trend produced by HostNickel, it is expected that the next billing level plateau will be achieved at the start of year 3 of the study when the monthly cost will rise to $10,000.00/month. This rate is expected to remain the same throughout the duration of the study.

An aside: According to industry sources, the average cost of storing 1TB of file data is currently $3,351.00/year (about $280.00/month). The rate shown above for the archival backup service would be correct for an organization which is archiving about 27 TB/month.

Project Two: The Proposed Scenario

- The virtualization project proposed for the HostNickel would reduce its current number of physical servers from 2000 to 200 (an overall 10:1 consolidation ratio). The proposed reduction in physical servers and the resulting number of virtual servers per server group will be based on the following table:

Group	Number of New Physical Servers	Physical Server Consolidation Ratio	Number of New Virtual Servers	Total Number of Servers in Group (physical + virtual)	Number of servers lost from current scenario	Overall Consolidation Ratio
1	100	7.5:1	450	550	200	1.36:1
2	60	13.3:1	350	410	390	1.95:1
3	10	7.5:1	30	40	35	1.875:1
4	30	12.5:1	100	130	245	2.88:1
TOTAL	**200**	**10:1**	**930**	**1130**	**870**	**2.016:1**

- Sun Server X8-8 servers have been selected to host the virtualized environments. This is one of Sun's latest and leading edge x86 servers. This is a 5 rack unit (5U) server that supports installations of 24 cores/socket. Up to 6TB of memory is available.

Project Two: The Proposed Scenario

- **Project Hint #4:**

- Note that our proposed scenario some of the original servers are acutally lost in the virtualization scenario. For example, the Group 1 servers are reduced from 750 physical servers to 100 physical servers (a consolidation ration of 7.5:1). The original 750 servers are replaced with 100 new physical servers and those new physical servers will support a total of 450 virtual servers. In this case, we lost 200 of the original servers. Similarly, in Group 3, the physical servers are reduced from 75 to 10 (also a consolidation ratio of 7.5:1) and the 10 new physical servers are supporting 30 virtual servers. In this case we lost 35 of the original servers.

- Although it isn't really important to us in this study, the most likely scenario for Group1, is that task/application/functionality of the original 750 servers will be distributed across the 450 virtual servers, and the 100 new physical servers will only be tasked with supporting the virtual machines and will probably have no other functionality assigned to them.

- Due to the efficiency of the new servers and the virtualization of the others, we can afford to reduce the total number of servers. Notice that the overall consolidation rations are all less than 3:1, with the mission critical consolidation rations around 2:1.

- The next page will let you know how to specify the configuration of the new physical servers that HostNickel will be purchasing for this proposed project.

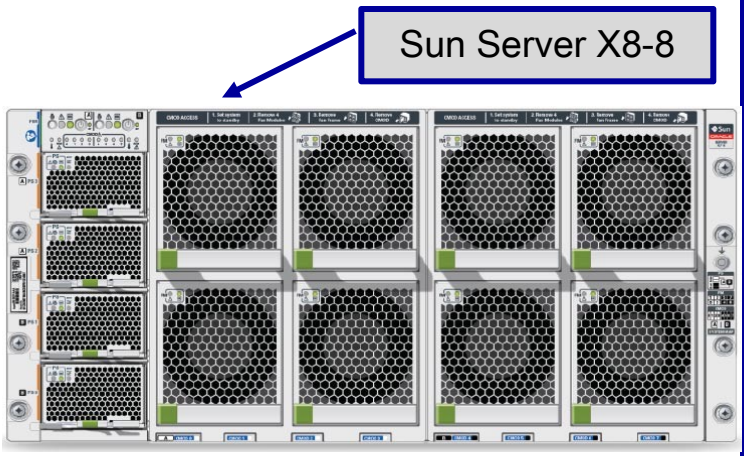
Project Two: The Proposed Scenario

- Information on the X8-8 model specifically can be found at: https://www.oracle.com/servers/x86/x8-8

- Use the configurations shown below:

- Processor = Intel Xeon 8268 2.9GHz, 24 core, 205W
- CPUs = 8
- Memory (64GB DIMM) = 96 DIMMs
- Memory (32GB DIMM) = none
- Memory (16GB DIMM) = none
- Hard Disk Drives = none
- Solid State Drives = 8 SSDs
- PCI-Express Card =16 PCIe Cards
- Workload = 85% for Group1 and 60% for Group 2

Group 1 and Group 2 Server configurations



- Processor = Intel Xeon 5218 2.3GHz, 16 core, 125W
- CPUs = 4
- Memory (64GB DIMM) = 48 DIMMs
- Memory (32 GB DIMM) = none
- Memory (16GB DIMM) = none
- Hard Disk Drives = none
- Solid State Drives = 4 SSDs
- PCI-Express Card = 8 PCIe Cards
- Workload = 75% for Group 3 and 50% for Group 4

Group 3 and 4 configuration

Project Two: The Proposed Scenario

- To determine the cost of the new servers, go to the following page: https://www.dell.com/en-us/work/shop/rack-servers/sf/poweredge-rack-servers?~ck=bt
- Note that this cost calculator is, actually, for the Dell PowerEdge R940xa Rack Server, which is different than the X8-8 servers that we configured for the power. While this configuration is not exactly the same as that which we configured for the power calculator, its pretty close and will give us an accurate enough value for inclusion in our analysis.
- Use the default loaded configuration price (starting at $xx.xx) for the Group 3 and 4 servers. For Group 1 and 2 servers, modify the configuration to include the selection in the Intel Xeon Platinum Processor category shown on the next page. Also modify the configuration to in add four of the 3.84TB SSD SATA drives (see page 18).
- The first-year price for the maintenance contract on each server will be 12% of the cost of the new server

Intel® Xeon® Platinum Processors

2x Intel® Xeon® Platinum 8256 3.8G, 4C/8T, 10.4GT/s, 16.5M Cache, Turbo, HT (105W) DDR4-2933	+ $3,061.34
2x Intel® Xeon® Platinum 8270 2.7G, 26C/52T, 10.4GT/s, 35.75M Cache, Turbo, HT (205W) DDR4-2933	+ $3,779.43
2x Intel® Xeon® Platinum 8260 2.4G, 24C/48T, 10.4GT/s, 35.75M Cache, Turbo, HT (165W) DDR4-2933	- $3,099.13
2x Intel® Xeon® Platinum 8276 2.2G, 28C/56T, 10.4GT/s, 38.5M Cache, Turbo, HT (165W) DDR4-2933	+ $7,193.52
x Intel® Xeon® Platinum 8260L 2.4G, 24C/48T, 10.4GT/s, 35.75M Cache, Turbo, HT (165W) DDR4-2933	+ $2,973.15
2x Intel® Xeon® Platinum 8276L 2.2G, 28C/56T, 10.4GT/s, 38.5M Cache, Turbo, HT (165W) DDR4-2933	+ $15,369.68
2x Intel® Xeon® Platinum 8280L 2.7G, 28C/56T, 10.4GT/s, 38.5M Cache, Turbo, HT (205W) DDR4-2933	+ $19,010.53
2x Intel® Xeon® Platinum 8268 2.9G, 24C/48T, 10.4GT/s, 35.75M Cache, Turbo, HT (205W) DDR4-2933	Included in price
2x Intel® Xeon® Platinum 8280 2.7G, 28C/56T, 10.4GT/s, 38.5M Cache, Turbo, HT (205W) DDR4-2933	+ $11,817.02
® Xeon® Platinum 8253 2.2G, 16C/32T, 10.4GT/s, 22M urbo, HT (125W) DDR4-2933	- $7,344.69
eon Platinum 8276L 2.2G,28C/56T,10.4GT/s,38.5M urbo,HT (165W) DDR4-2933,Optane DCPMM	+ $2,214.75
2xIntel Xeon Platinum 8280L 2.7G,28C/56T,10.4GT/s,38.5M Cache,Turbo,HT (205W) DDR4-2933,Optane DCPMM	+ $5,820.32
2xIntel Xeon Platinum 8260L 2.4G,24C/48T,10.4GT/s,35.75M Cache,Turbo,HT (165W) DDR4-2933,OptaneDCPMM	- $5,820.32

less

Select this option

Click the “More” arrow first to show all the options.

Hard Drive

Help Me Choose

SATA SSD

- [x] 480GB SSD SATA Read Intensive 6Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD — Included in price
  Qty - 1 + $440.30 /ea.
- [ ] 960GB SSD SATA Read Intensive 6Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD, — $660.77 /ea.
- [ ] 480GB SSD SATA Mix Use 6Gbps 512 2.5in Hot-plug AG Drive, 3 DWPD, — $597.78 /ea.
- [ ] 1.92TB SSD SATA Read Intensive 6Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD, — $1,196.19 /ea.
- [ ] 960GB SSD SATA Mix Use 6Gbps 512 2.5in Hot-plug AG Drive, 3 DWPD, — $975.72 /ea.
- [x] 3.84TB SSD SATA Read Intensive 6Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD, — Included in price
  Qty - 4 + $2,267.03 /ea.
- [ ] 1.92TB SSD SATA Mix Use 6Gbps 512 2.5in Hot-plug AG Drive, 3 DWPD, — $1,794.60 /ea.
- [ ] 1.92TB SSD SATA Mixed Use 6Gbps 512e 2.5in Hot Plug S4610 Drive — $2,298.52 /ea.
- [ ] 480GB SSD SATA Mixed Use 6Gbps 512e 2.5in Hot Plug S4610 Drive — $786.75 /ea.

▲ less

Select this option and add 4 of these drives

Click the “More” arrow first to show all the options.

Project Two: The Proposed Scenario

- The virtualization software of choice will be VMware (we'll use VMware vSphere) and this will cost $6500/physical server. The yearly maintenance contract on this software will be priced at 15% of the original cost and will remain in effect at this rate for the duration of the study.

- Each new server will be under a server maintenance contract that will have an initial cost as per your research (see page 16) and this cost will increase by 3% in each year of the study.

- It is estimated that all new servers (both physical and virtual) will require 10 weeks/server/year of administrative effort. Groups 1, 2, and 3 will require a backup effort assumed to be 90 min/physical server/day. Group 4 servers will require 120 min/physical server/week.

- Training employees on the new virtualized systems will require a time expenditure equivalent to $5500/year/employee trained on the system. In years 1 and 2 of the study four employees will be trained and in all subsequent years of the study two employees will be trained per year.

Project Two: The Proposed Scenario

- **Project Hint #5:**

- Physical servers require backups, virtual servers do not. The virtual server resides on the physical server, so in backing up the physical server, the virtual servers residing on that physical server are also backed up.

- Both physical and virtual servers require administrative efforts. The difference is that the administrative cost/effort on a virtual machine is assumed to be only 55% (see page 21) of the administrative cost/effort on a virtual machine. For example, if a physical server requires 10 hours of administrative effort/week, then the cost for that would be 10 hours x $75.00/hour = $750.00. If that physical server hosted 4 virtual machines that also each required 10 hours of administrative cost/effort/week, then the cost for administering the virtual machines would be (4 x 10 hours x $75.00/hour) * 0.55 = $1650.00. Thus, the total administrative cost/effort on that one physical server in 1 week would be $750.00 + $1650.00 = $2400.00.

Project Two – Common Elements

- Some basic assumptions about HostNickel and the future as it pertains to your cost/benefit analysis:
  - The cost of 1kwH of power is currently 13 cents. Assume that the cost of power will increase 2%/year over the duration of the study.
  - When calculating power costs for the new servers, note that the loading of each server was already factored into the value produced by the power calculator.
  - Assume that server maintenance costs will increase 3%/year over the duration of the study for all server maintenance agreements.
  - The outside service contracts for security and storage will continue in the proposed scenario just as they are tdefined in the current scenario.
  - Assume that administrative costs on a virtual server are 55% of the administrative costs on a physical server.
  - 1 administrative day is 10 hours long. 1 server day is 24 hours long. There are 365 days in one year. Assume that administrative costs will increase at the rate of 2%/year over the duration of the study.

Project Two: Your Task

- Your first task for this project is to construct spreadsheets like the ones we discussed in class that will illustrate the current and proposed infrastructure costs for the HostNickel given this proposed virtualization project.

- You should create (1) a constants and shared variables spreadsheet, (2) a variables spreadsheet that includes all the variables defined in the project, (3) a current infrastructure cost spreadsheet, (4) a virtualization project cost spreadsheet, and (5) a summary spreadsheet that highlights the major costs and benefits of the project.

IMPORTANT ! ! !

You must create your spreadsheet using variables to identify the various costs that are being tracked. In other words, don't hard code any numbers into the formulas in your spreadsheets. The following page illustrates one of the variables pages in my spreadsheet where I defined the variables used in current cost spreadsheets. You must include a similar page(s) in your spreadsheet. Also see the template on WebCourses.

	A	B	C	D	E
1	**Variables Used In This Spreadsheet**				
2	**Hard Costs**				
3		Value	Variable Name	Variable Description	
5			numServersGroup1	GroupA consists of this many 3200W servers	
6			numServersGroup2	Group 2 consists of this many 3800W servers	
7			numServersGroup3	Group 3 consists of this many 2800W servers	
8			numServersGroup4A	Group 4A consists of this many 3800W servers - backup servers	
9			numServersGroup4B	Group 4B consists of this many 2800W servers - backup servers	
11			serverPowerGroup1	power in watts of the servers in group 1	
12			serverPowerGroup2	power in watts of the servers in group 2	
13			serverPowerGroup3	power in watts of the servers in group 3	
14			serverPowerGroup4A	power in watts of the servers in group 4A	
15			serverPowerGroup4B	power in watts of the servers in group 4B	
17			serverLoadGroup1	average load of the servers in group 1	
18			serverLoadGroup2	average load of the servers in group 2	
19			serverLoadGroup3	average load of the servers in group 3	
20			serverLoadGroup4A	average load of servers in group 4A	
21			serverLoadGroup4B	average load of servers in group 4B	
23			maintenanceCostYear1Group1	cost of maintenance contract year 1 - servers in group 1	
24			maintenanceCostYear1Group2	cost of maintenance contract year 1 - servers in group 2	
25			maintenanceCostYear1Group3	cost of maintenance contract year 1 - servers in group 3	
26			maintenanceCostYear1Group4A	cost of maintenance contract year 1 - servers in group 4A	
27			maintenanceCostYear1Group4B	cost of maintenance contract year 1 - servers in group 4B	
29			securityFirmMonthlyCharge	cost per month for security auditing service - outside vendor	
30			dataStorageMonthlyChargeYears1And2	cost per month for storing archival backups - years 1 & 2 - outside vendor	
31			dataStorageMonthlyChargeYears3Thru5	cost per month for storing archival backups - years 3,4 5 - outside vendor	
33			costkwHYear1	cost of 1 kwH or power in year 1	
34			powerRateIncrease	assume 2% increase in cost of power/year of study	
35			maintenanceRateIncrease	assume 3% increase in server maintenance cost each year of study	
37	**Soft Costs**				
38			administrativeCostPerHourYear1	cost of administrative time per hour in year 1	
39			administrativeRateIncrease	administrative pay increase amount	
40			weeksAdministrativeTimeGroup1	weeks of administrative time per server Group 1	
41			weeksAdministrativeTimeGroup2	weeks of administrative time per server Group 12	
42			weeksAdministrativeTimeGroup3	weeks of administrative time per server Group 3	
43			weeksAdministrativeTImeGroup4A	weeks of administrative time per server Group 4A	
44			weeksAdministrativeTImeGroup4B	weeks of administrative time per server Group 4B	
46			hoursPerBackupGroup1	hours per backup of server in Group 1	
47			hoursPerBackupGroup2	hours per backup of server in Group 2	
48			hoursPerBackupGroup3	hours per backup of server in Group 3	
49			hoursPerBackupGroup4A	hours per backup of server in Group 4A	
50			hoursPerBackupGroup4B	hours per backup of server in Group 4B	
52			numberOfBackupsPerYearGroup1	number of backups performed on servers in Group 1 in 1 year	
53			numberOfBackupsPerYearGroup2	number of backups performed on servers in Group 2 in 1 year	
54			numberOfBackupsPerYearGroup3	number of backups performed on servers in Group 3 in 1 year	
55			numberOfBackupsPerYearGroup4A	number of backups performed on servers in Group 4A in 1 year	

Project Two: Your Task

- Once your spreadsheets are completed, you'll construct a 1 page executive summary report of your findings.
- This report should address the feasibility of the proposed project and its financial impact on the HostNickel.
- Normally, an executive summary summarizes a more complete accompanying report. You will not be preparing this more complete report in this case, you will only be preparing the executive summary.
- If you have never prepared an executive summary before (if you did project 1, you've have now done so), the following links might be useful:

  http://en.wikipedia.org/wiki/Executive_summary

  http://libguides.wpi.edu/c.php?g=355392&p=2396307

  http://writing.colostate.edu/guides/documents/execsum/

Project Two: Your Task

- Note that an executive summary is different from an abstract.
- Abstracts tend to be most common in academic environments whereas executive summaries are primarily confined to business environments.
- An abstract is a brief summarizing statement which is read by people who are trying to decide whether or not to read the entire document.
- An executive summary is the document in miniature which can be read in place of the longer document.

Project Two: Deliverables

- On or before 11:59 pm (WebCourses time) Sunday February 20, 2022 submit the following items via WebCourses:

  1. A spreadsheet (similar to that we developed in the notes) with worksheets containing variable definitions, current cost infrastructure, proposed project cost infrastructure, and a summary worksheet. Feel free to use the spreadsheet template on WebCourses as starting point for your project.

  2. A one page executive summary of your findings with respect to the feasibility of this project for the HostNickel. This executive summary should give an extremely brief overview of the proposed project, a summary of your findings (spreadsheet analysis results), and a recommendation of whether the project should move forward or not.