Cloud Computing Project

- ☑ ~~Tasks Calculate the energy consumption and cost of operation for the as-is infrastructure! (Assume an average load!)~~
- ☑ ~~Calculate the TCO (total cost of ownership) of the infrastructure as-is (energy, personal, etc.). For networking energy consumption consider 1000W for Switches and Routers! For personal consider 3 full time employees!~~

Cost of operation for the as-is infrastructure (Annual Cost) = Energy Cost (Cooling system, switches and routers, 7 servers avg. load, clients) + Salaries (60000+100000+70000) + Licensing cost (assuming zero as most of the software are outdated or free source) + Maintenance cost = 25341 + 230000 + 0 + 7000 = 262341 €

Cost of operation for the as-is infrastructure (5 Years) = Cost of operation for the as-is infrastructure (Annual Cost) * 5 = 262341 * 5 = 1311705 €

Total cost of ownership (For 5 Years) = Cost of operation + Initial cost (Buying cost assuming zero as it is already present) = 1311705 + 0 = 1311705 €

References

Total 7 servers + 17 clients + cooling system + switches and routers:

Department	Hardware	Specs	Power Consumption	
Finance	1 App Server	Xeon X5680, 8GB RAM, 500 GB HDD	1000W	RHEL 7 free MySQL Community 5.7 free Java Application (Java 1.8) free JBoss Application Server (EAP 7.4) free
HR	1 App Server	Xeon X5680, 8GB RAM, 2 TB HDD	1000W	Microsoft SQL 2012 no license req Windows server 2012 no license req Java Servlet-Application (Java 1.7) free Tomcat 7.0 Server free
Warehouse	1 App Server	Xeon X5680, 8GB RAM, 1 TB HDD	1000W	Debian Server 5.0 Lenny free PHP 5.3 program free MySQL 5.5 Database on Server free
Sales	1 App Server	Xeon X5680, 16GB RAM, 2 TB HDD	1000W	RHEL 7 free CRM SAP 2008 (7.0) eoc
Sales	1 Storage	Intel Xeon	1200W	Ubuntu 16.04 LTS free

	Server	E7 4830, 32GB RAM, 10TB Tape drive		
Operations	1 App Server	Intel Xeon E7 4830, 32GB RAM, 3TB HDD	1200W	Windows Server 2012 no license req Microsoft SQL 2012 no license req Java JSP-Application (Java 9) free Tomcat 8.0 Server free
Webshop	1 Web Server	Intel Xeon E7 4830, 128GB RAM, 500GB SSD	1200W	Debian9.0 free Drupal 7.3 free
Finance	4 Clients		500W	
HR	3 Clients		500W	
Warehouse	10 Clients		500W	
Cooling			6866W	
Switches and routers			1000W	

Calculate the average power consumption for the servers:

Total power consumption of 7 servers = 1000 + 1000 + 1000 + 1000 + 1200 + 1200 + 1200 =7600 W

Power consumption for average load = Total Power consumption of 7 servers/No. Of servers = 7600/7 = 1086 approx

Total power consumption of 17 clients = 1500 W

Power consumption for average load = Total Power consumption of 17 servers/No. Of servers = 1500/17 = 88 approx

To calculate the annual energy consumption (7 servers (avg. load) + 17 clients (avg. load) + cooling system + switches and routers = 9040 W), assuming the servers operate continuously for one year (8760 hours), we can use the formula:

Energy consumption (kWh)=Power (kW)×Time (hours)

Given:

- Power (kW) = 9.04 kW
- Time (hours) = 8760 hours (assuming the servers operate continuously for one year)

Energy consumption (kWh) = 9.04 kW×8760 hours

Energy consumption (kWh) = 79190.4 kWh

So, the annual energy consumption for a total power consumption of

9040 watts is 79190.4 kWh.

Energy cost (€) = Energy consumption (kWh) * Cost per kWh (€)

Given:
- Energy consumption = 130979.52 kWh (as calculated earlier)
- Cost per kWh = 32 cents = 0.32 euros (used the average rate from 2 companies that provide energy for commercial use)

Now, plug in the values into the formula:
Energy cost (€) = 79190.4 kWh * 0.32 €/kWh
Energy cost (€) = 25341 € approx

So, the estimated energy cost for total power consumption of 9040 watts over a year, based on the cost of 32 cents per kilowatt-hour for commercial customers in Germany, would be approximately 25341 euros.

https://www.entega.de/geschaeftskunden/tarifvergleich/

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These three roles are crucial for maintaining servers:

1. **System Administrator**:
    a. Manages day-to-day server operations, user accounts, and performs maintenance tasks like updates and backups.
    b. Approximate salary: €60,000 per year.

https://www.glassdoor.de/Salaries/germany-systems-administrator-salary-SRCH_IL.0,7_IN96_KO8,29.htm?countryRedirect=true

2. **Network Administrator**:
    a. Oversees networking infrastructure, ensuring reliable connectivity, configuring network services, and implementing security measures.
    b. Approximate salary: €100,000 per year.

Salary: Network Administrator in Germany 2024 | Glassdoor

3. **Security Specialist**:

a. Focuses on cybersecurity, conducting risk assessments, implementing security controls, monitoring for threats, and educating staff on security best practices.
b. Approximate salary: €70,000 per year.

[Cyber Security Engineer salary in Germany]

A reasonable budget allocation for hardware maintenance and replacement parts for 7 servers could range from a few hundred to several thousand euros per year, depending on the factors mentioned above. It's essential to regularly reassess your budget and adjust as needed based on changing circumstances, such as the aging of servers, changes in warranty coverage, or shifts in risk factors. Additionally, consulting with a professional IT services provider or hardware vendor can help you develop a more precise budget tailored to your specific needs and circumstances.

Certainly! Let's focus solely on the cooling cost for your server infrastructure. To calculate the cooling requirement, you'll need to determine the heat load generated by the servers and networking equipment, and then estimate the cooling capacity required to maintain optimal operating temperatures in your server room or data center.

For cooling:

Based on the information that we only have a 19 inch server rack.

We have assumed the room is small and has 2 wall mounted for redundancy a/c's working 24/7 with cooling capacity of 12000 BTU each.

Power consumption of 1 a/c is average of below 3 a/c's (3400 + 3500 + 3400)/3= 3433.33W

PC= 3433W (Note:- Took the round number)

For 2 such a/c's power consumption is 3433*2 = 6866W=6.866 Kw

https://klimando.com/Mitsubishi-Klimaanlage-R32-Wandgeraet-Basic-MSZ-HR35VF-34-kW-I-12000-BTU?ref=gs&gad_source=1&gclid=CjwKCAjwi_exBhA8EiwA_kU1MoTo677F2uyhw-bJn1NEytXSuXvB09jwkCUuoUL1fQYISErCDhgowRoC5OsQAvD_BwE

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https://www.amazon.de/-/en/Home-Deluxe-12-12000-compatible-function/dp/B0C1H3KZ79/ref=sr_1_6?crid=3VQ4FD7UWWGSU&dib=eyJ2IjoiMSJ9.89lhRJ7DOv01WsxZy-K1t_nwmQ6TsJtiX24sxkUYm7c1qWqWkFlx8zJLF4NOtWO9lg0Z5GBiJMeYG4csfn8OUzhKylmGpOpfDwL-QKEW6VYCnZNjhWmhsWDziZjgPtZM.esS-B2742JYEIaDgzKKN3-OvZo3lANjUUDnI7Gjf

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Questions

What to do with downtime and maintenance time?

Have considered average load for both clients and servers separately. Do I need to consider average load for both?

Did not include laptops when calculating power consumption. Is that okay?