**Assignment 7**

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1. **When trying to achieve linearity between energy usage and compute usage there is a need to feedback some of the compute needs to energy control plane. Suggest some techniques to apply such feedback (Hint: Slide8). Explain your answer in GREAT details.**

We suggest that energy proportionality should be added as a design goal for computing components. Ideally, energy-proportional systems will consume almost no power when idle and gradually consume more power as the activity level increases. A simple way to reason about this ideal curve is to assume linearity between activity and power usage, with no constant factors. Such linear relationship would make energy efficiency uniform across the activity range, instead of decaying with decreases in activity levels. Note, however, that linearity is not necessarily the optimal relationship for energy savings. It can be argued that because servers spend relatively little time at high activity levels, it might be ne even if efficiency decreases with increases in activity levels, particularly when approaching maximum utilization.

To apply the feedback of compute needs to energy control plane, we have following techniques:

1. Using software to operate hardware when needed

In order to find out the compute needs and feedback that to energy control plane, we will certainly need a software to manage the hardware so that the hardware could work efficiently.

1. Using “sleep” mode in server/rack

Using sleep mode in server or rack at suitable time will reduce the waste of energy since we avoid letting the system run when nobody is using it.

1. Using SSD instead of HDD

SSD is much faster than HDD, so using SSD will improve the speed or efficiency of system strongly.

1. **We discussed the need to measure IT equipment energy consumption. Explain why it is important? How we can measure such energy consumption? (Hint: Slide6). Explain your answer in GREAT details.**

IT power is the power consumed by the actual computing equipment. IT power is also referred to in the literature as critical power. Because PUE factors are oblivious to the nature of the computation being performed, they can be objectively and continuously measured by electrical monitoring equipment without any disruption to normal operations. It is commonly accepted that a well-designed and well-operated datacenter should have a PUE of less than 2. Although PUE captures the facility overheads, it does not account for inefficiencies within the IT equipment itself. Servers and other computing equipment use less than 100% of their input power for actual computation. In particular, substantial amounts of power may be lost in the server’s power supply, voltage regulator modules, and cooling fans.

The reason why IT equipment power is important is because it not only defines the workloads, but also creates baseline.

Measuring the IT equipment energy consumption is very important. Such a measurement can be useful for comparing the relative efficiency of two WSCs or to guide the design choices for new systems. Existing installations can measure their own energy efficiency by load testing their services while adequately instrumenting the facility to measure or estimate energy usage. In the absence of standardized cluster-level benchmarks, server-level bench- marks can also be useful as long as meaningful extrapolations are possible. Two recently released benchmarks provide a good starting point for such energy efficiency accounting in servers: Joulesort and SPECpower\_ssj2008 benchmark. Joulesort consists of measuring the total system energy to perform an out-of-core sort and attempts to derive a metric that enables the comparison of systems ranging from embedded devices to supercomputers. SPECpower instead focuses on server- class systems and computes the performance-to-power ratio of a system running a typical business application on an enterprise Java platform.

1. **Name three takeaways from week 7 lecture.**

Learnt the definition of PUE and how to calculate it.

Learnt the facts which will affect PUE value and how to improve it.

Learnt how to measure and improve the efficiency of computing system.

1. **In class we conducted a benchmark using live\_socket\_srv.c and socket.c. The benchmark collected information about the number of open descriptors. Conduct the benchmark on your VM and share the results of your max server capacity.**

**Useful commands:**

**Assuming the server name process is proc1 finding the process PID `ps aux | grep proc1`**

**Find the number of open connections to the server. `sudo netstat -anp | grep PID | wc –l` or `sudo lsof | grep PID| wc -l`**

**Find the memory consumption of the server while processing the load. `sudo ps aux | grep PID| awk '{ print $4,$5}’`**

**Use “#!/bin/bash while true; do echo the command; sleep 5; done”**

**Launch an new VM and install tomcat HINT - Slide13**

**Submit all your code, scripts and configuration (if any) in the a separate directory in our class GitHub project.   
The way of creating new folder for your in guthub is simply add new file but modify the path of the file with a directory. See example in the screen shot attached.**

1. Write code for the shell application of client:

vi connector.sh

#!/bin/bash

while true;

do

./socket.o 172.31.31.216 8888;

done

1. Run the live\_socket\_srv.o application: ./live\_socket\_srv.o
2. Write code for the shell application of server:

Vi checkor.sh

#!/bin/bash

while true;

do

sudo lsof | grep 5884|wc –l;

sudo ps aux | grep 5884|awk ‘{print $4,$5}’;

done

1. Run checkor.sh:

Chmod 777 checkor.sh

Sudo ./checkor.sh

1. Run connector.sh

Chmod 777 connector.sh

Sudo ./connector.sh

The result is shown as the pictures below. The max capacity of server is 1029.

