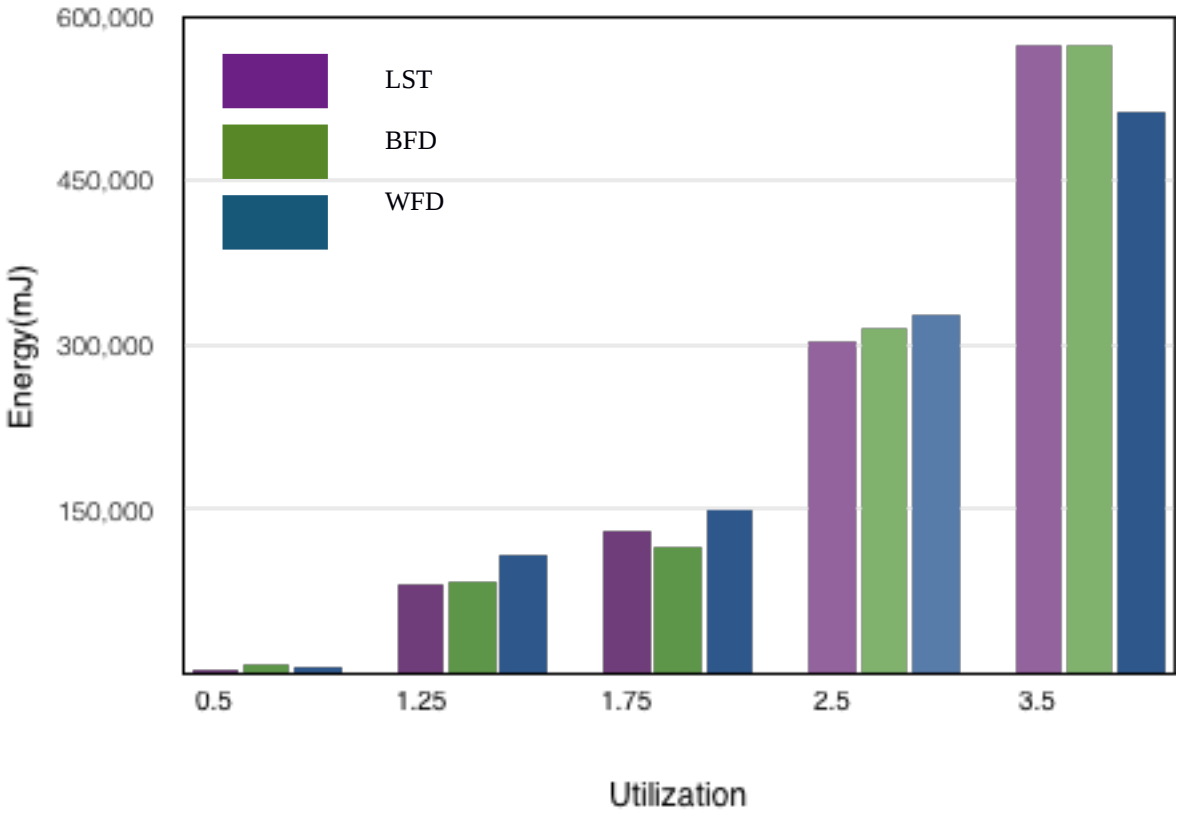
Lab 4 WriteUp

Energy Plot:

In the figure below , as the utilization increases, the frequency of the cpu will increase. So the increased utilization and frequency both cause energy consumed increasing. Among the three kinds of scheduling policy, there is no conclusion which one is better than the others. This is because the performance of the policy related to many factors, such as the property of the task set, whether the task set is harmonic, what kind of other system thread is running on this core, and what is the real utilization in one period for thread. So there is a variation even for the same test set. So under different cases, the optimal scheduling policy for different kind of task set is different.



1. (2 points) When and why would you want to compile your kernel in NO_HZ configuration?

If we want to save power we can compile kernel in NO_HZ configuration. This is because NO_HZ configuration will let the kernel run without a regular time tick. This means the kernel will not have to wake up to service the timer so it can do less work and save power.

2. (2 points) What kernel subsystem decides which sleep state the processor enters and what parameters does it use to make the decision?

The **cpuidle** subsystem within the kernel decides sleep state a processor enters. It defines C states, these states are defined with certain properties like **exit latency** and **power Consumption**. These states are chosen and manipulated based on a layer of abstraction called cpuidle governors that decides based on the policy what state will be best suited. For example C3 ideal for power save but not good for performance.

The C states are :

C state	Exit Latency (uS)	Power Consumption
C1	1	1000
C2	1	500
C3	57	100

C-States also indicate what systems are of the cpu are active, for eg. In C3 all the parts of the cpu are powered down, whereas in C1 state only the cpu clocks are turned off. In C2 state the cpu clock along with a few more external clocks are turned off.

3. (2 points) What are advantages and disadvantages of the wake locks solution adopted by the Android fork of the Linux kernel?

Wake locks are used by Android applications to prevent processors from entering sleep states. For some applications, they need computation time even after the display turns off. So they use the wake locks to let CPU turn off display but not enter sleep state. This is the main advantage of the wake locks. On the other hand, the main disadvantage of the wake locks is that some application may use the wake locks unnecessarily and make unnecessary waste of energy.

4. (2 points) In the kernel you are working on for Nexus 7, does voltage always change when frequency changes?

Yes the nexus 7 kernel supports DVFS so it changes voltage as per change in frequency, this makes the kernel more power efficient. The values decided for the frequencies are a part of optimum combination of Voltage and Frequency for maximizing power saving.

5. (2 points) In ARM architecture, what instruction can be used to enter a low-power processor state?

In order to make the processor enter a low-power state, the Wait-For-Interrupt instruction can be used. This instruction will make the processor suspend execution until an IRQ interrupt or an FIQ interrupt takes place or a Debug Entry request made to the processor.