

CSC714 HW7
Group 12:Yifan Zhu

Project Topic: Feedback DVS-EDF Scheduling on Crusoe Processor

Project Status:

A feedback DVS-EDF scheduler has been implemented for Crusoe Processor, written in C under Linux. Tasks are implemented as subroutines. Preemption is implemented through timer interrupts. Tasks' timing constraints are read from an input file. Actual power consumption is measured for different task sets.

Experimental Results:

Energy consumption is tested in two approaches. First, the scheduler keeps track of every task's executing frequency, voltage and actual execution time. Power consumption is accumulated by: $power += frequency * voltage^2 * actual_exec_time$. Second, actual power consumption in terms of battery life is measured by Linux tool *apm*. Multiple task-sets are tested with varied task-set utilization. An optimal power consumption value (every task runs at the lowest frequency level without consideration of deadline misses) and a worst-case power consumption value (no task scaling, every task runs at the maximum frequency level) is also calculated for comparison. Experimental results are shown in the following.

1. Task set1: Pillai's sample task set (WCET utilization=0.75), executed for 30 minutes

1.1 Battery life used

- (1) feedback DVS-EDF: 19% battery life used
- (2) optimal : 13% battery life used
- (3) worst-case : 21% battery life used

1.2 Power consumption calculated by the scheduler:

- (1) feedback DVS-EDF: 906915
- (2) optimal : 505455
- (3) worst-case : 1311772

2. 3task-set with varied utilization(cc=50%WCET), executed for 30 seconds

2.1 Power consumption calculated by the scheduler

Utilization	feedback DVS-EDF	worst-case	ours/worst
0.1	10951.199674	119167.156025	9%
0.2	3006.000114	14652.299873	20%
0.3	5803.800153	53064.771770	10%
0.4	2665.419312	7575.239055	35%
0.5	3006.000072	13187.069983	23%
0.6	2204.028952	4395.689964	50%
0.7	3339.699996	7370.106840	45%
0.8	3552.650786	4395.689964	80%
0.9	deadline missed		

Open Problems:

1. The battery life measured for feedback DVS-EDF is not as low as expected when compared to the optimal value. It may be due to the scheduling overhead in the scheduler. Further analysis of the source code is needed to attack this problem.
2. When utilization reaches high (≥ 0.9), deadline misses happened during the execution. This is because the actual execution time of each task is controlled by a *for* loop. Even with the same number of iterations, the execution time of the loop varies from time to time (sometimes it doubles). A more precise approach controlling the actual execution time for each task is needed.