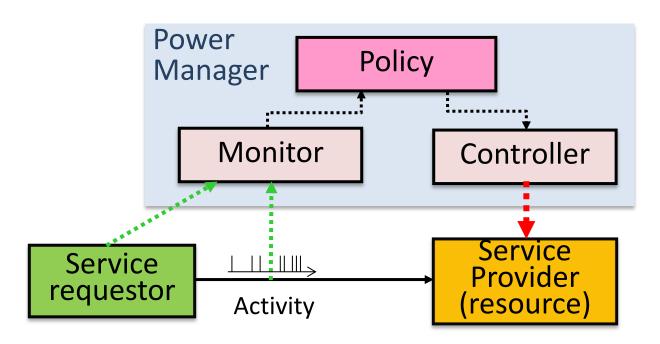
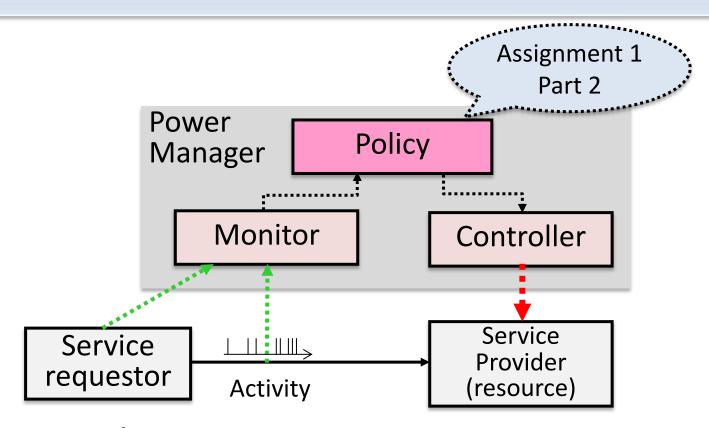
Lab 1 – Day 2 Dynamic Power Management

Recall



- Power manager (PM)
 - Monitors requestor's activity and sets state of provider according to some **policy** (implemented inside the PM)

Recall

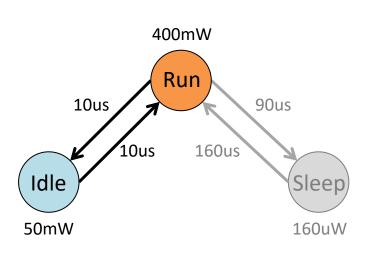


- Policy implementation
 - Extend the timeout policy

Assignment 1 – Part 2 Extension of the timeout policy

DPM simulator

- The DPM simulator supports a timeout policy with transitions from ACTIVE to IDLE
 - Never goes to SLEEP state
 - Moving to SLEEP may save even more energy...



```
[sim] Active time in profile = 0.300130s
[sim] Idle time in profile = 0.244066s
[sim] Total time = 0.544196s
[sim] Timeout waiting time = 0.024679s
[sim] Total time in state Run = 0.324809s
[sim] Total time in state Idle = 0.219387s
[sim] Total time in state Sleep = 0.000000s
[sim] Time overhead for transition = 0.022770s
[sim] N. of transitions = 2277
[sim] Energy for transitions = 0.022770J
[sim] Energy w/o DPM = 0.217678J, Energy w DPM = 0.163663J
[sim] 24.8 percent of energy saved.
```

 Modify the timeout policy to enable transitions also to SLEEP

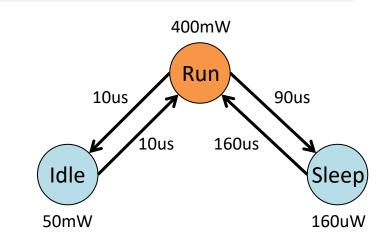
Must modify the implementation of the DPM simulator

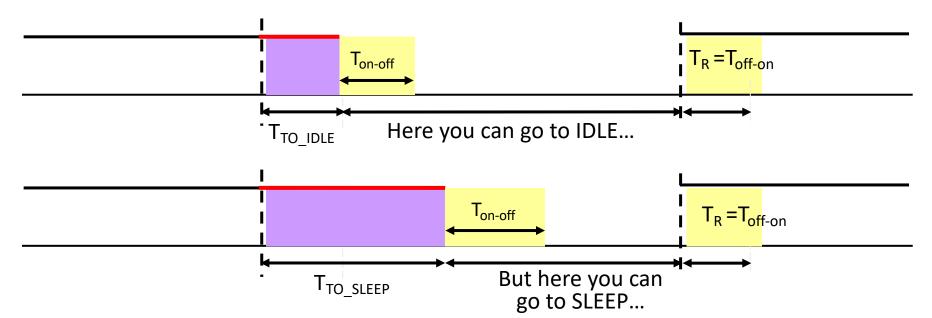
```
400mW
Run
90us
10us
160us
Sleep
50mW
160uW
```

```
switch (policy) {
```

```
case DPM_TIMEOUT:
    if(curr_time > idle_period.start +
tparams.timeout[0]) {
       *next_state = PSM_STATE_IDLE;
    } else {
       *next_state = PSM_STATE_ACTIVE;
    }
    /* LAB 2 EDIT */
    break;
```

- Use two timeouts...
 - Note that there is no explicit transition between IDLE and SLEEP!
 - Add the transition in the PSM





- print_command_line()(src/utilities.c)
 - Prints the command line to invoke the tool
- parse_arg() (src/utilities.c)
 - Parses the inputs you provide via command line
 - For the timeout policy:
 *selected_policy = DPM_TIMEOUT;
 tparams->timeout[0] = atof(argv[++cur]);
 value passed as parameter after -t

 May have to be extended to take 2 timeouts in input (one for IDLE and one for SLEEP)

- dpm_decide_state()(src/dpm_policies.c)
 - Provided system state
 - Workload status (active/idle)
 - Current simulation time
 - Adopted policy (i.e., timeout)
 - Determines what is the state at the next time step

Extend TIMEOUT case to support also transition to sleep

```
switch (policy) {

case DPM_TIMEOUT:
    if(curr_time > idle_period.start + tparams.timeout[0]) {
        *next_state = PSM_STATE_IDLE;
    } else {
        *next_state = PSM_STATE_ACTIVE;
    }
    /* LAB 2 EDIT */
    break;
    But.. What about SLEEP?
```

- dpm_simulate()(src/dpm_policies.c)
 - Emulates policy application to the PSM given the workload
 - For all instants in the current (active and idle) period
 - Invoke dpm_decide_state() to apply the policy and determine transitions
 - Check the state returned and update energy consumption accordingly

In synthesis...

- Update the parse_arg() and dpm_decide_state() functions to support transitions also to SLEEP
 - Need an appropriate timeout for SLEEP...

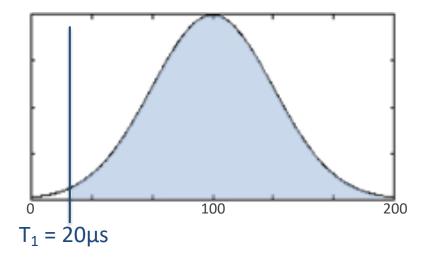
```
400mW
Run
10us
160us
Sleep
50mW
160uW
```

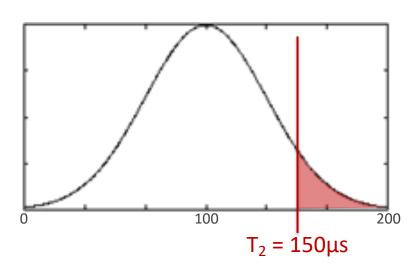
```
switch (policy) {
    case DPM_TIMEOUT:
        if(curr_time > idle_period.start +
    tparams.timeout[0]) {
         *next_state = PSM_STATE_IDLE;
        } else {
         *next_state = PSM_STATE_ACTIVE;
        }
        /* LAB 2 EDIT */
        break;
```

- Report assignment:
 - Comparison between example timeout and extended timeout policies
 - What changes with IDLE→SLEEP?
 - Timeout vs. energy saving
 - How does energy saving change w.r.t.
 - The workload distribution?
 - The adopted timeouts?
 - » E.g., timeout is exactly T_{BE} , lower than T_{BE} , higher than T_{BE}
 - Timing overheads to perform transitions?

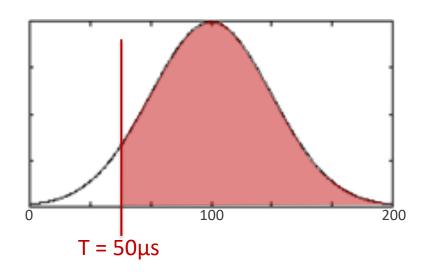


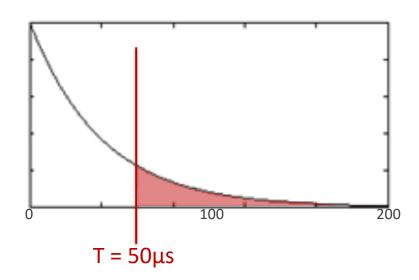
- Example: how does energy saving change w.r.t. the adopted timeout?
 - Remember: distribution histogram
 → per each time value, the number of samples that have that value
 - How many idle periods will last longer/shorter?





- Example: how does energy saving change w.r.t. the workload distribution?
 - How many idle periods will last longer/shorter?
 - Normal distribution and exponential distribution have very different behaviors...





Example:

- Why do I get these power savings?
 - Why is policy 2 worse than policy 1 on distribution 4?
 - Why is it better on distribution 2?
 - Why is policy 1 better on distrib. 2 than on distrib. 5?
 - Why is sometimes the power saving negative?
 - ...?

	POLICY 1	POLICY 2
DISTRIB 1	0%	0%
DISTRIB 2	25%	27%
DISTRIB 3	0%	-2%
DISTRIB 4	10%	9%
DISTRIB 5	5%	11%

