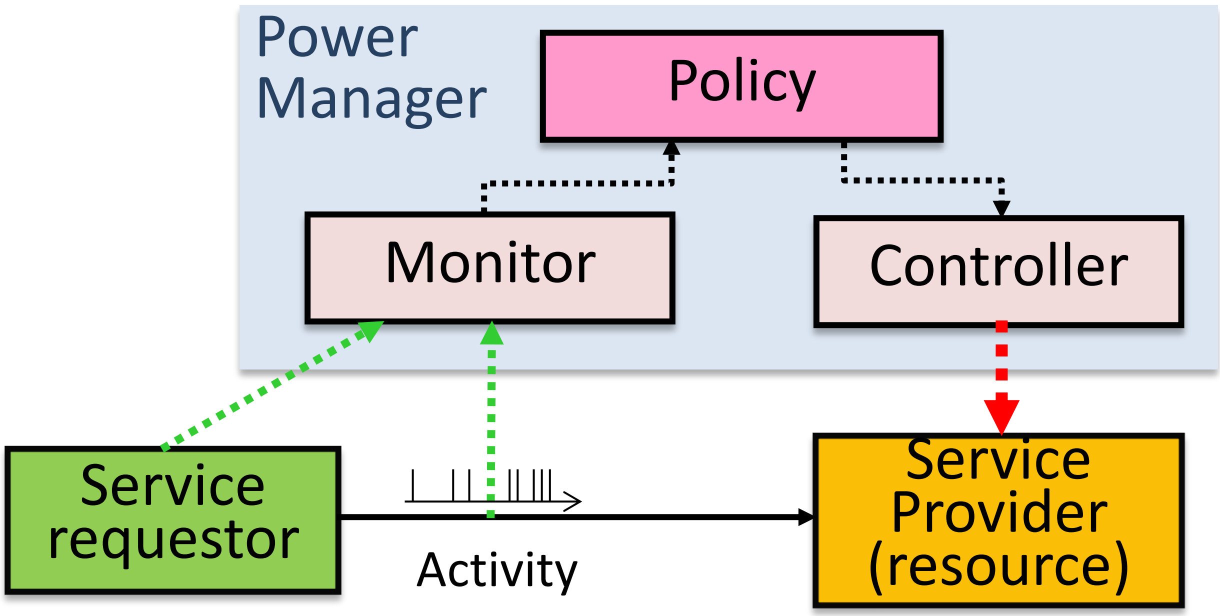
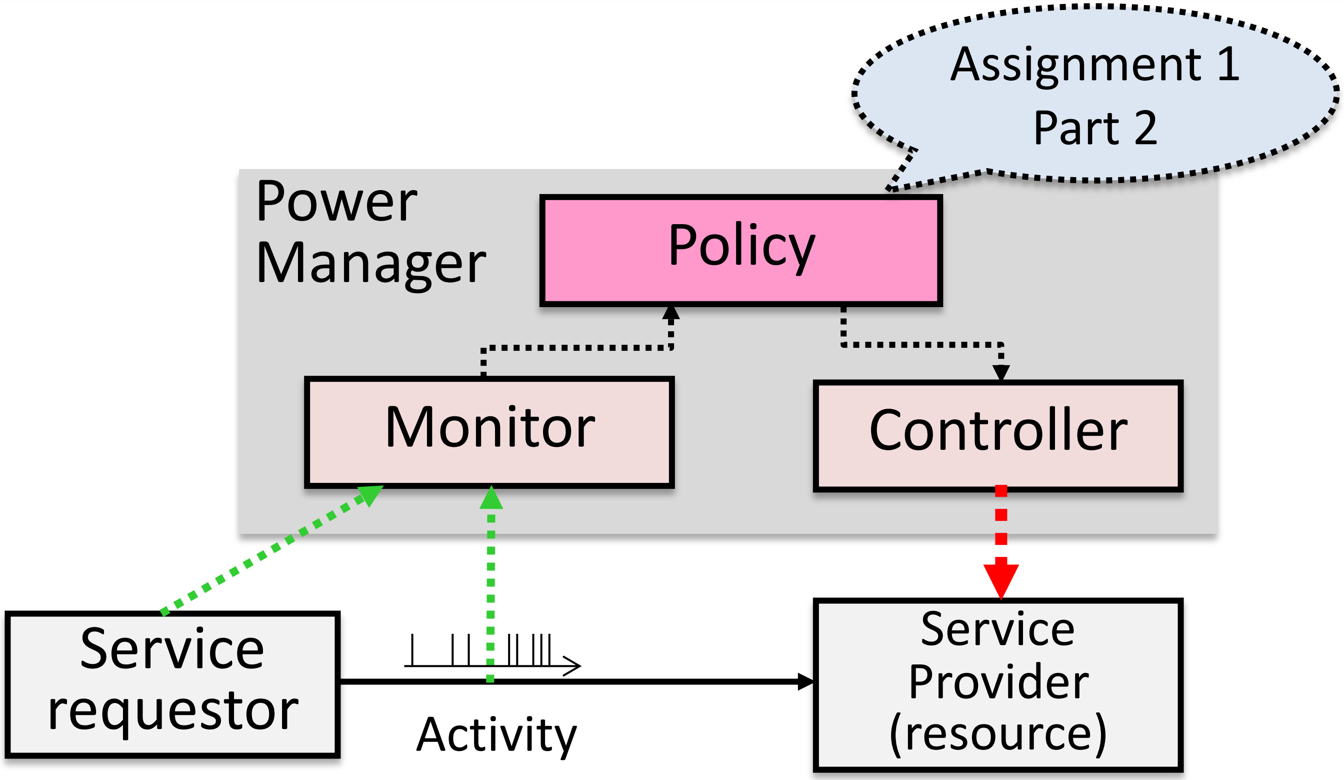
# Lab 1 – Day 2
# Dynamic Power Management

# Recall




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

# Recall

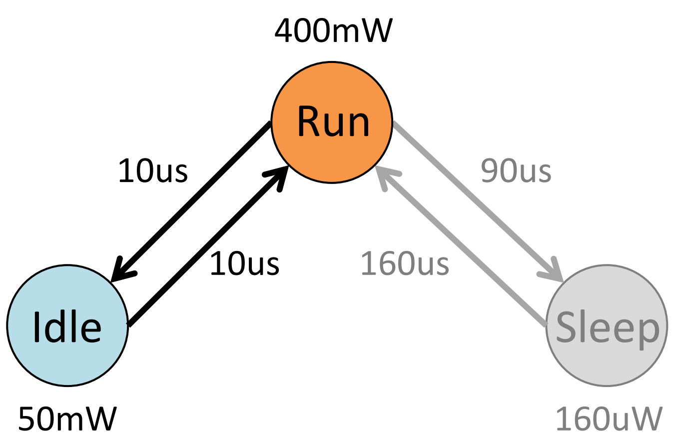



- Policy implementation
  - Extend the timeout policy

# Assignment 1 – Part 2
# Extension of the timeout policy

# DPM simulator

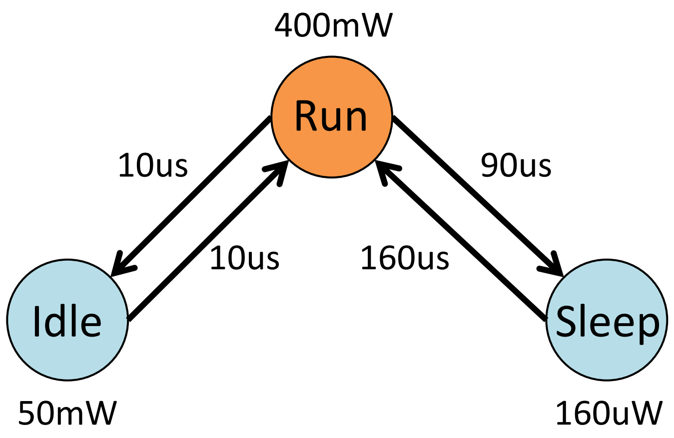
- The DPM simulator supports a timeout policy with transitions from ACTIVE to IDLE
  - Never goes to SLEEP state
  - Moving to SLEEP may save even more energy…




[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.

# Assignment 1 – Part 2

- Modify the timeout policy to enable transitions also to SLEEP
  - Must modify the implementation of the DPM simulator

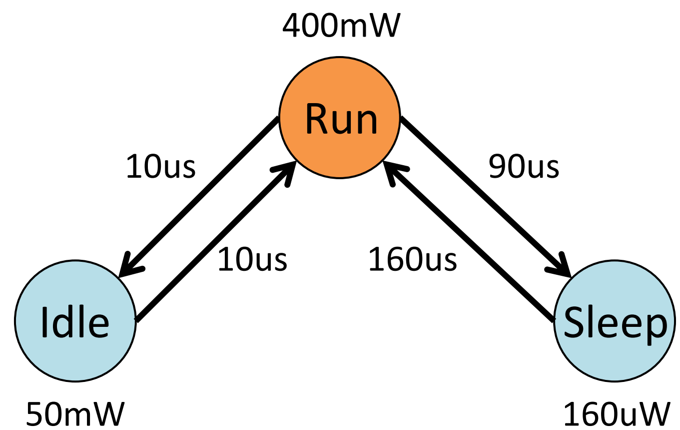


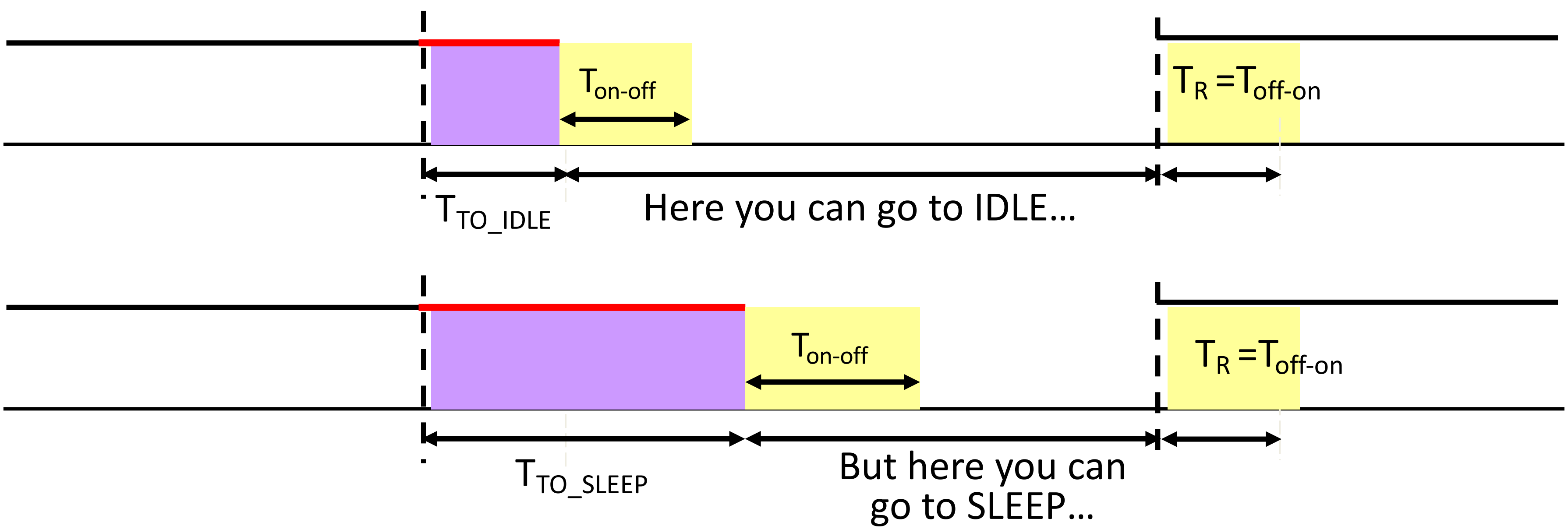

```
switch (policy) {

    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;
```

# Assignment 1 – Part 2

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



# The DPM simulator

- `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)

# The DPM simulator

- `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

# The DPM simulator

- 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;
```

Wait for the timeout and then go to IDLE

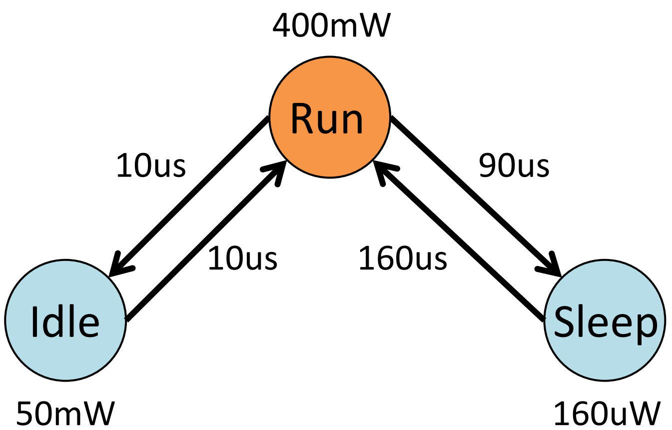
But.. What about SLEEP?

# The DPM simulator

- `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…

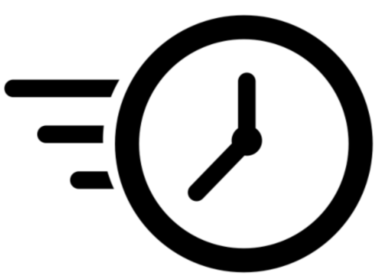



```
switch (policy) {

    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;
```

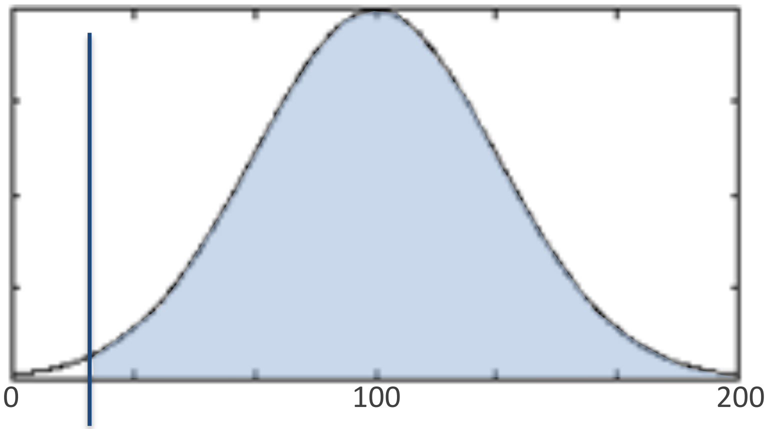
# Assignment 1 – Part 2

- 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?

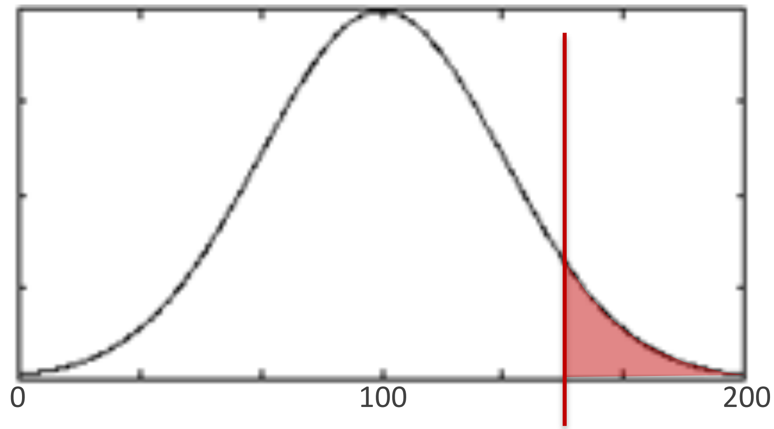


# Assignment 1 – Part 2

- 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?



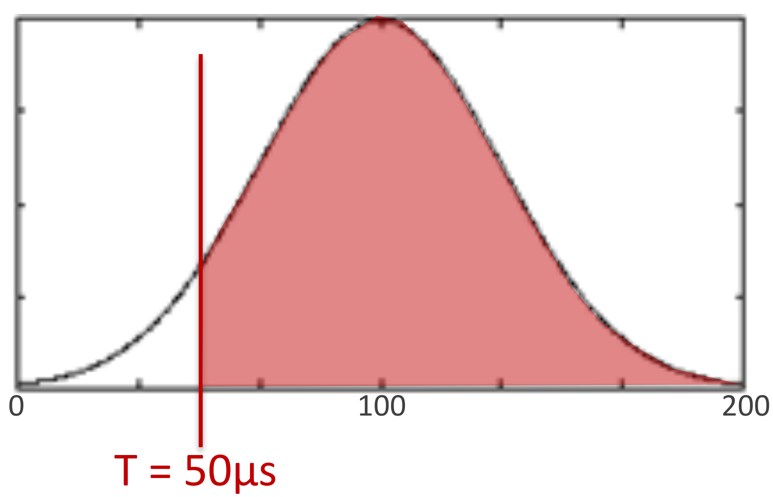

$T_1 = 20\mu s$

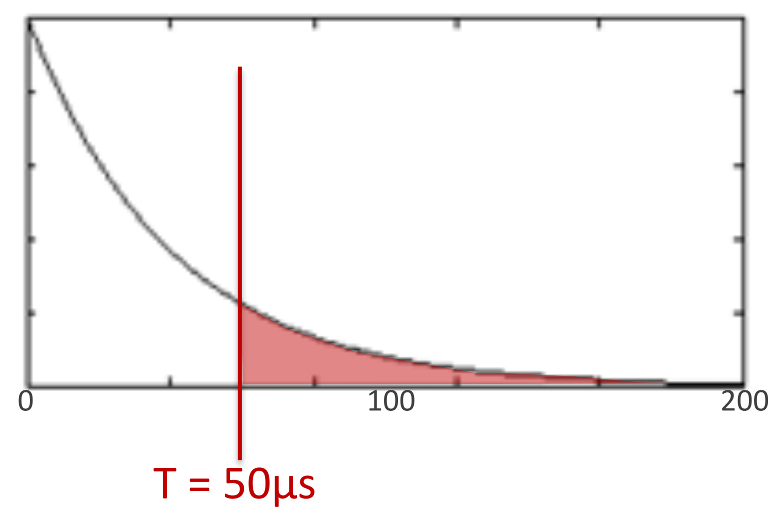



$T_2 = 150\mu s$

# Assignment 1 – Part 2

- 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…



# Assignment 1 – Part 2

- 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% |