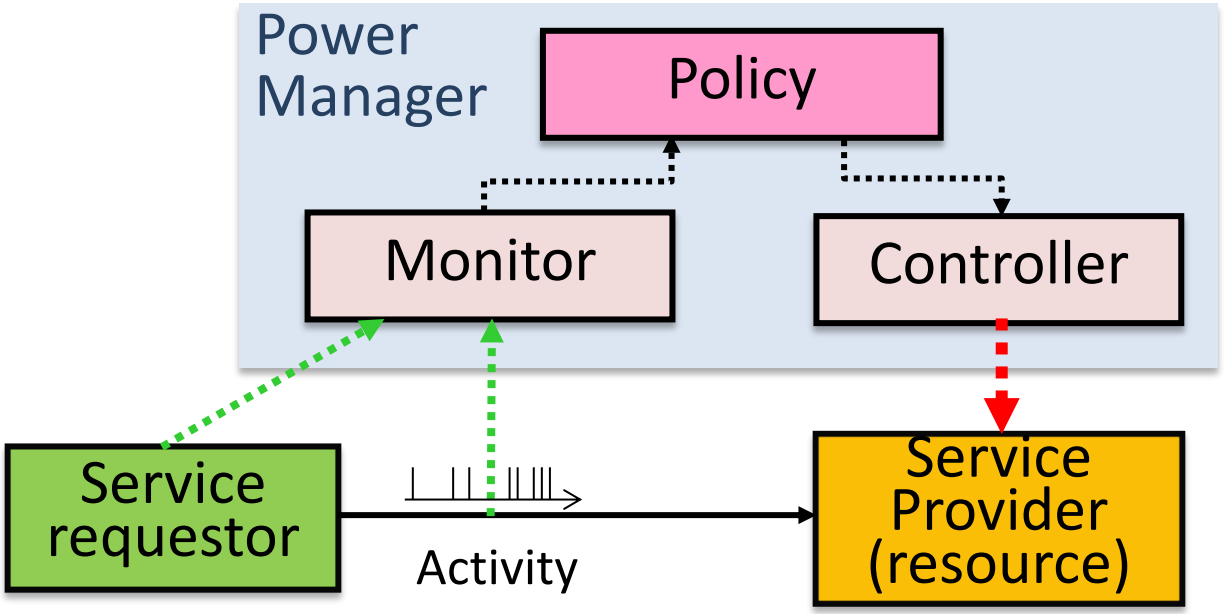
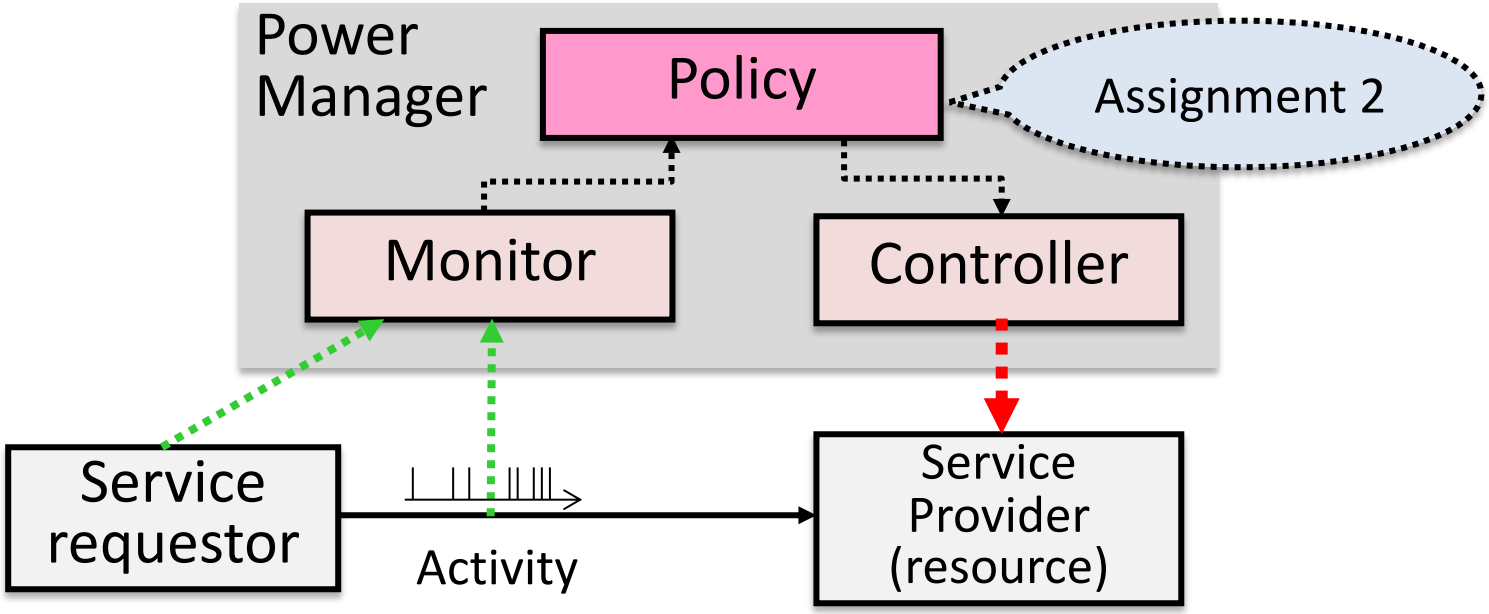
Lab 1 – Day 3
Dynamic Power Management

Recall



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

Recall

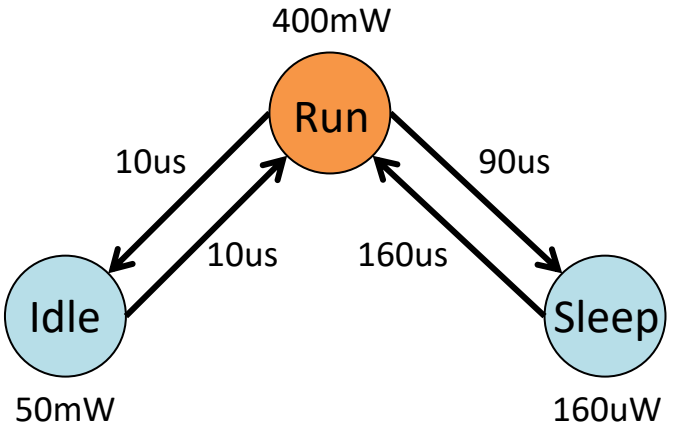


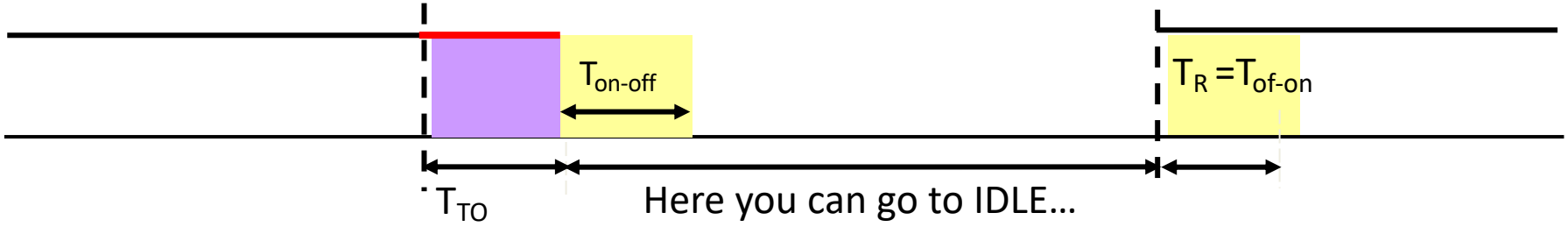
- Policy implementation
  - Implement the history-based policy

Assignment 2
History-based prediction policy implementation

Recall

- So far we worked with timeout policies…
  - Put the device in off state T_{TO} time units after it has entered the idle state





Recall

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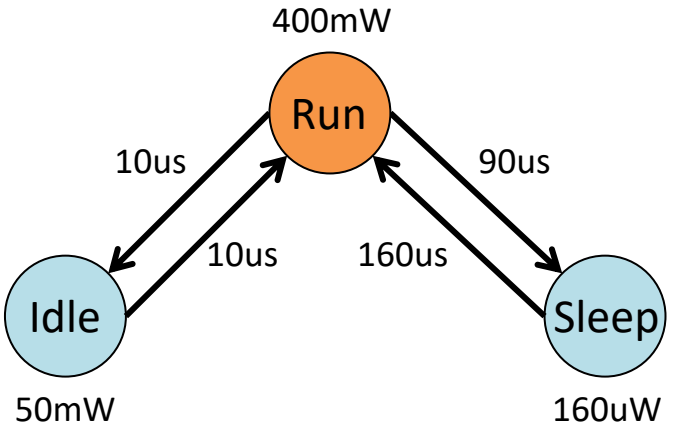
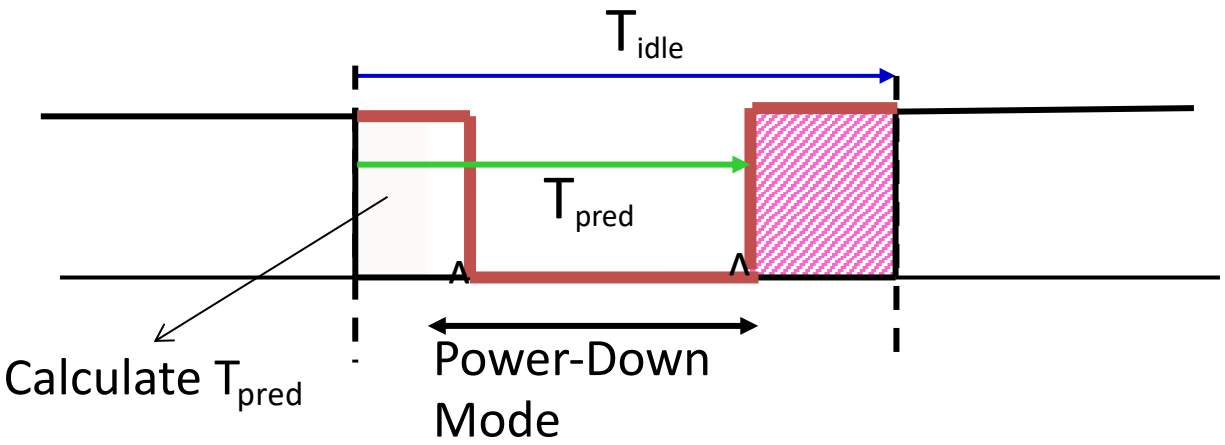
  - Put the device in off state T_{TO} time units after it has entered the idle state

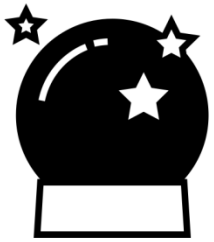


- Can history teach us something?



Recall

- Predictive policies
  - Predict idle period $T_{pred} \sim T_{idle}$
    - Use **history**
    - E.g., T_{active} and T_{idle} of previous period
  - Go to sleep state if T_{pred} is long enough to amortize state transition cost

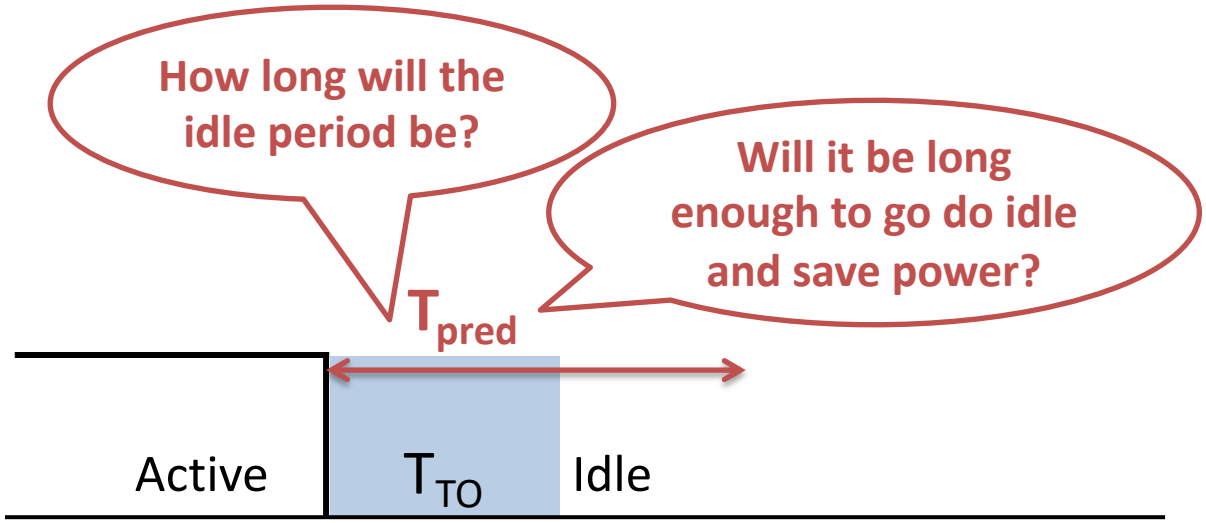


- Example (non-linear) regression equation:

$$T_{idle}[i] = K + K_1 \cdot T_{idle}[i-1] + K_2 \cdot T_{active}[i] + K_3 \cdot T_{active}[i]^2$$

Assignment 2

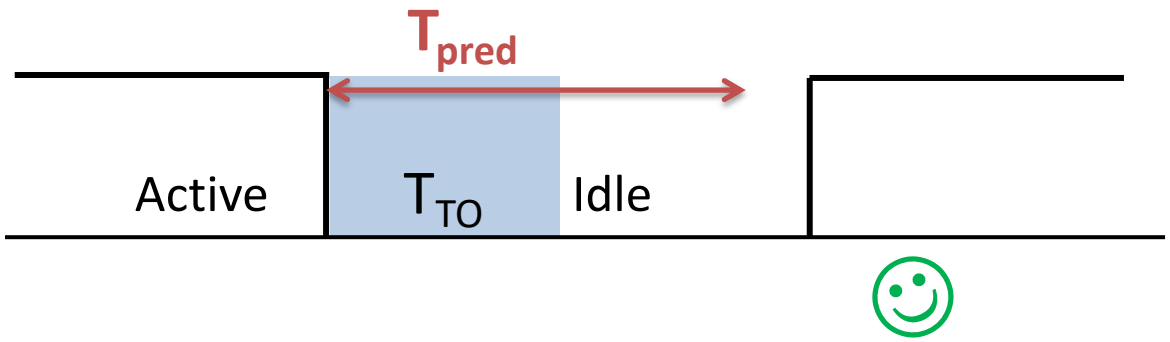
$$T_{idle}[i] = K + K_1 \cdot T_{idle}[i-1] + K_2 \cdot T_{active}[i] + K_3 \cdot T_{active}[i]^2$$



Assignment 2

$$T_{idle}[i] = K + K_1 \cdot T_{idle}[i-1] + K_2 \cdot T_{active}[i] + K_3 \cdot T_{active}[i]^2$$

Drawback: will my guess be right?



Assignment 2

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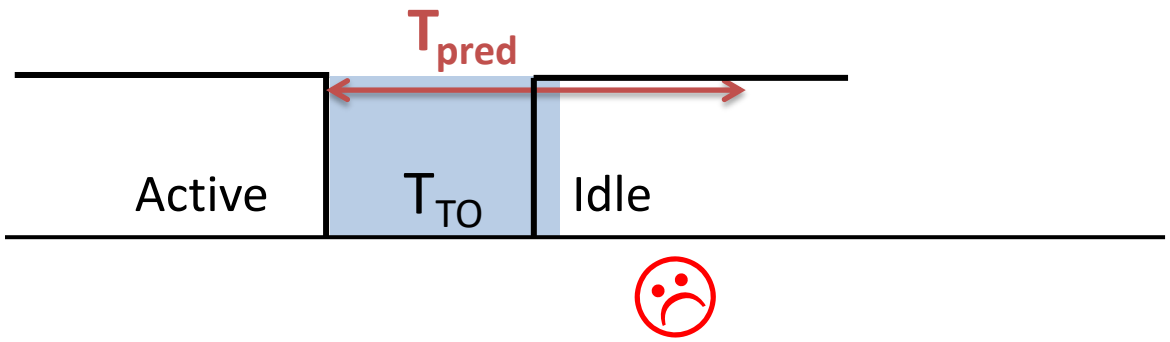
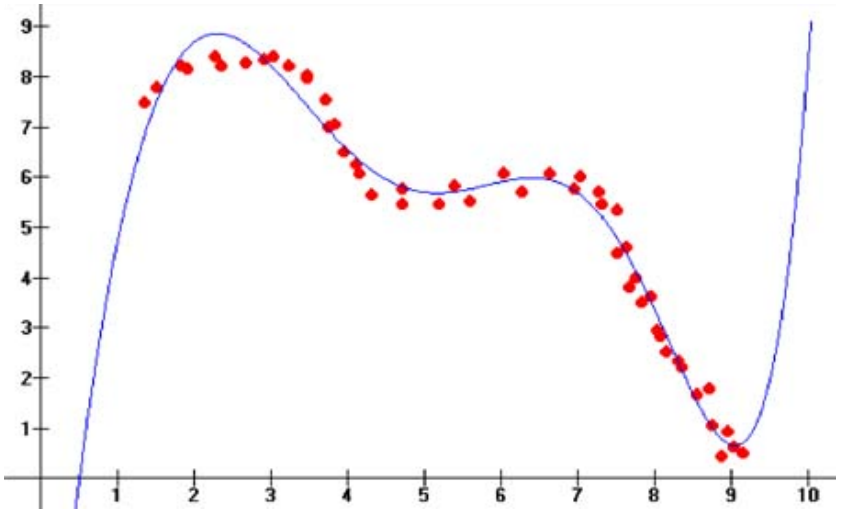


Parenthesis

- Polynomial Regression
  - Estimate the relationship between variables
    - Independent variables ~ my inputs
    - Dependent variable ~ the value I want to estimate
  - Estimated as a polynomial
    - Choose the grade
    - Get the coefficients s.t. the polynomial estimates «well» the samples



Parenthesis

- Regression
  - In our scenario, e.g.:
    - **Independent variables:** length of previous IDLE/ACTIVE periods
    - **Dependent variable:** length of current IDLE period
  - What are the coefficients for the polynomial s.t. it can estimate well?

$$T_{idle}[i] = K + K_1 \cdot T_{idle}[i\text{-}1] + K_2 \cdot T_{idle}[i\text{-}1]^2$$

Example

- E.g., Matlab polyfit function
  - http://it.mathworks.com/help/matlab/ref/polyfit.html

polyfit

Polynomial curve fitting

expand all in pa

Syntax

```
p = polyfit(x,y,n)
[p,S] = polyfit(x,y,n)
[p,S,mu] = polyfit(x,y,n)
```

Description

`p = polyfit(x,y,n)` finds the coefficients of a polynomial `p(x)` of degree `n` that fits the data, `p(x(i))` to `y(i)`, in a least squares sense. The result `p` is a row vector of length `n+1` containing the polynomial coefficients in descending powers:

$$p(x) = p_1 x^n + p_2 x^{n-1} + \ldots + p_n x + p_{n+1}.$$

Recall

- Predictive policies
  - Predict idle period $T_{pred} \sim T_{idle}$
    - Use **history**
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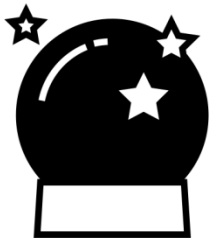


- Example (non-linear) regression equation:

$$T_{idle}[i] = K + K_1 \cdot T_{idle}[i-1] + K_2 \cdot T_{active}[i] + K_3 \cdot T_{active}[i]^2$$

Assignment 2

- Modify the simulator to implement a *history-based prediction policy*

```
case DPM_HISTORY:
        if(curr_time < idle_period.start) {
            *next_state = PSM_STATE_ACTIVE;
        } else {
            *next_state = PSM_STATE_ACTIVE;
            /* LAB 3 EDIT */
            // hparams.alpha[i] * history[i] ....
            //if(value_prediction ...)
            //    *next_state = PSM_STATE_ACTIVE; ...
        }
        break;
```

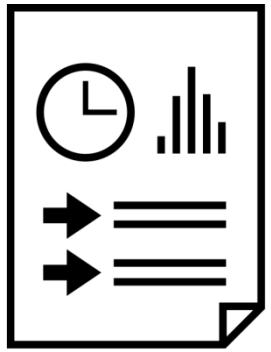
Evaluate the regression equation to determine T_{pred}

Assignment 2

- Modify the simulator to implement a *history-based prediction policy*
  - Choose any regression you like
    - E.g., that works well with the workload…
    - Note that the regression may consider a number of previous idle or active periods → *window size*
      - How far shall I go in the past?
      - How many past elements shall I consider?
  - Compute regression coefficients
    - E.g., with Matlab, but you can pick your favourite tool

Assignment 2

- Report assignment
  - Description of implemented predictive policy
  - Result of implemented predictive policy with the workload profiles
    - Analysis on:
      - Window size vs. energy saving
      - Coefficient values vs. energy saving (model order)
      - Timing/energy overhead
  - Comparison between predictive and timeout policies



End of Lab 1!
Now you're ready to prepare the first report…

The deadline is 23:59 of the day before the 2nd exam