

# Tuning Browser-to-Browser Offloading for Heterogeneous Stream Processing Web Applications

**Masiar Babazadeh**

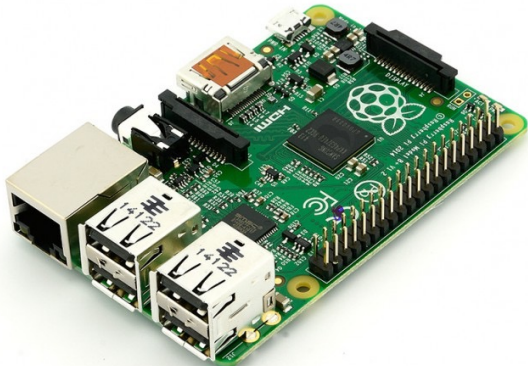
@masiarb

University of Lugano

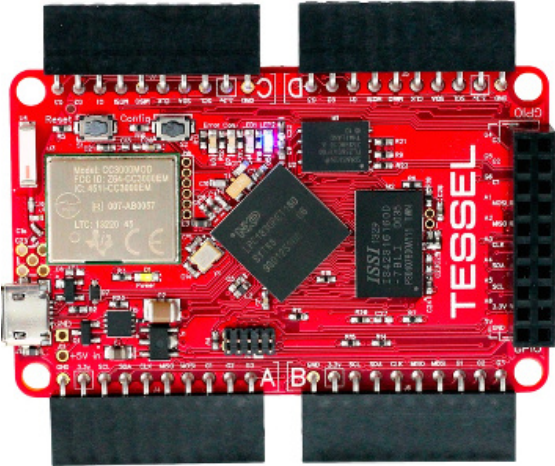
# Web of Things



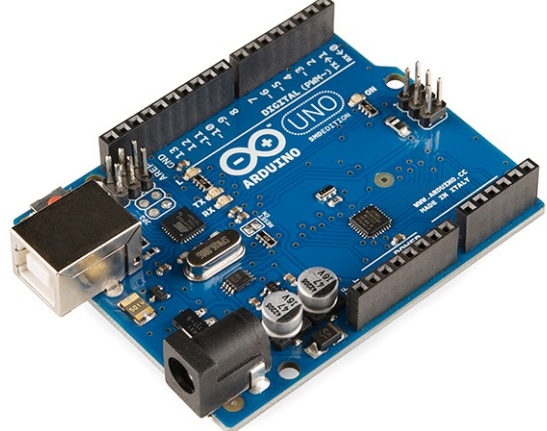
Smartphones



Raspberry Pi



Tessel



Arduino



# Programmable World



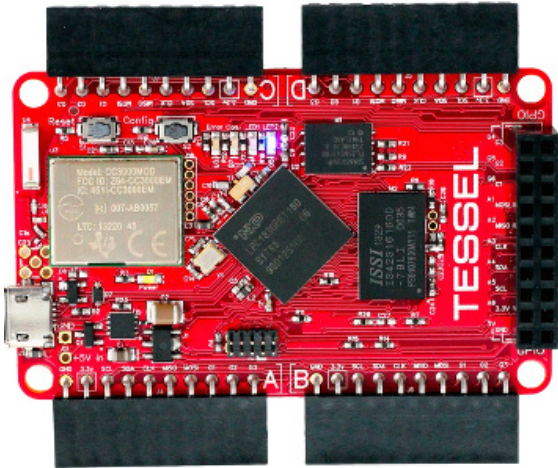
Swift / Java / C#



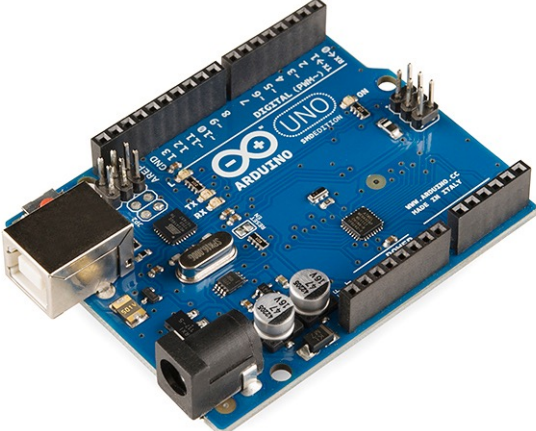
HTML+JavaScript



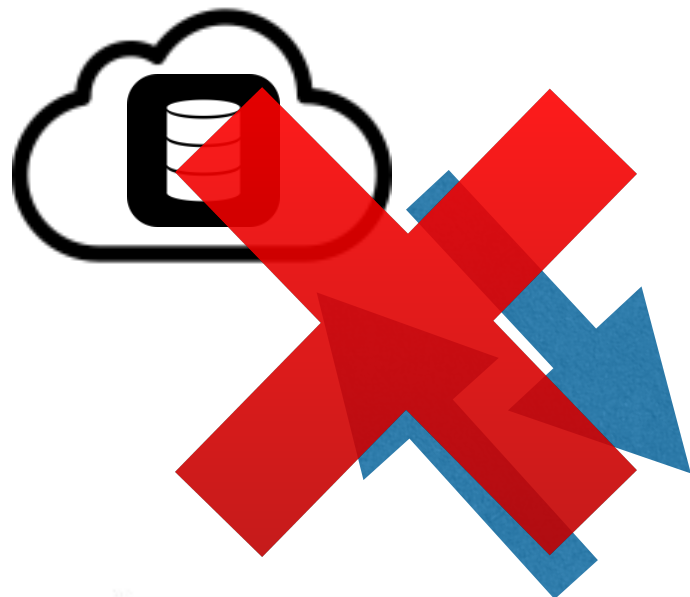
 Python



 JavaScript



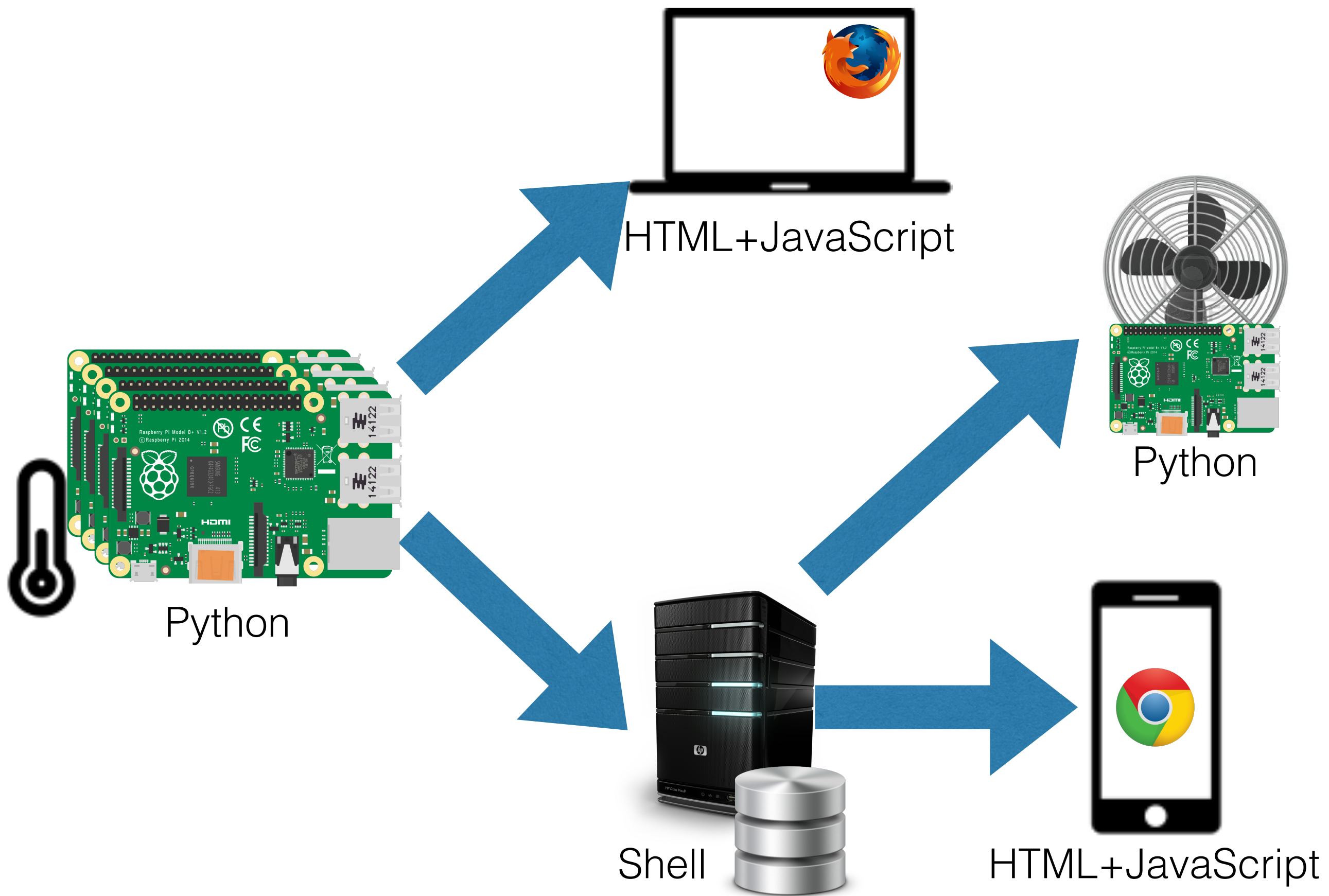
 Processing



OPTIONAL  
SCREENED  
PORCH  
12'-0" x 12'-0"

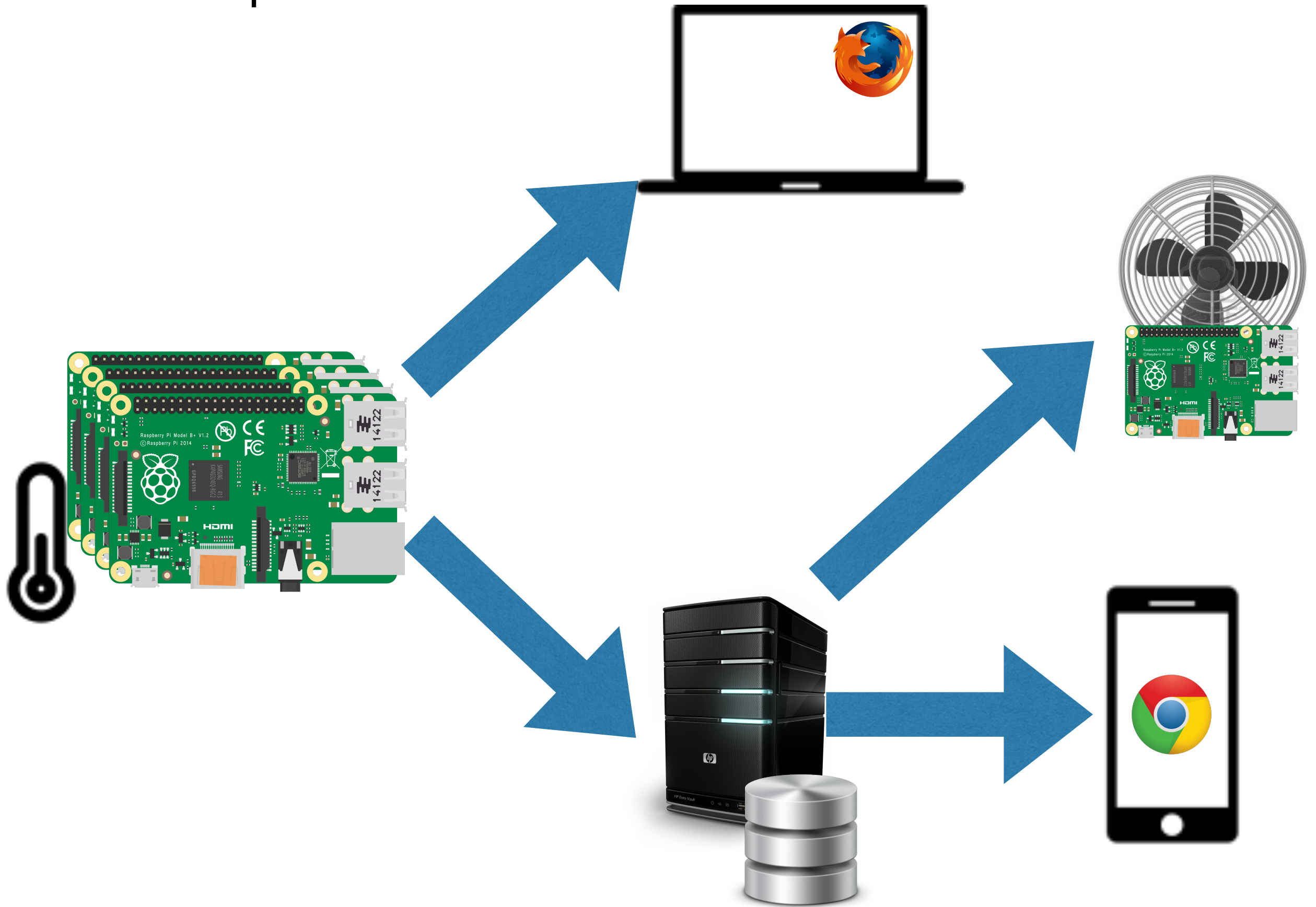


# Home Automation System





# Web Liquid Streams



# Web RTC



**HTML**



# J S

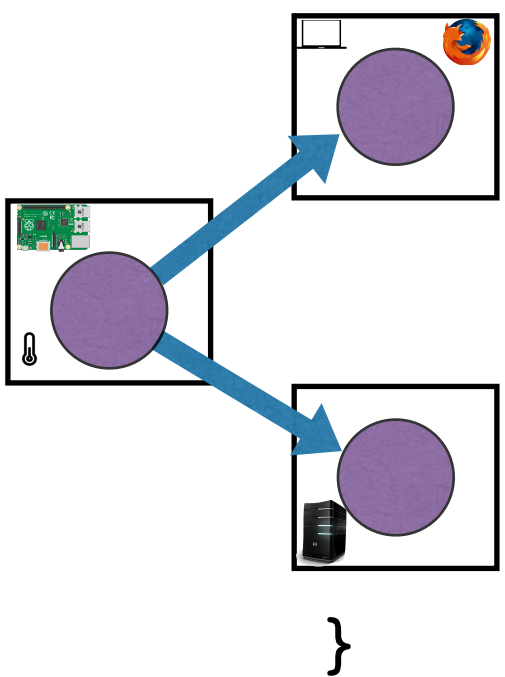
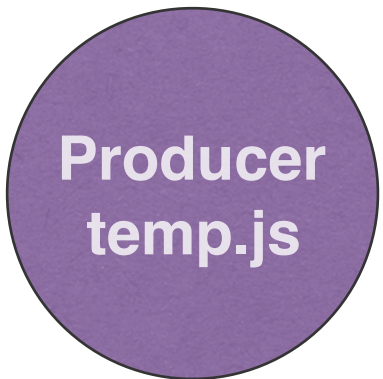
## Web Liquid Streams - Code

```
var k = require('wls.js');
setInterval(function(){
  getTemperature(
    function(temp, sensor_id){
      k.send({
        "temperature" : temp,
        "id" : sensor_id,
        "ts" : new Date().getTime(),
      });
    }
  );
}, 1000);
```



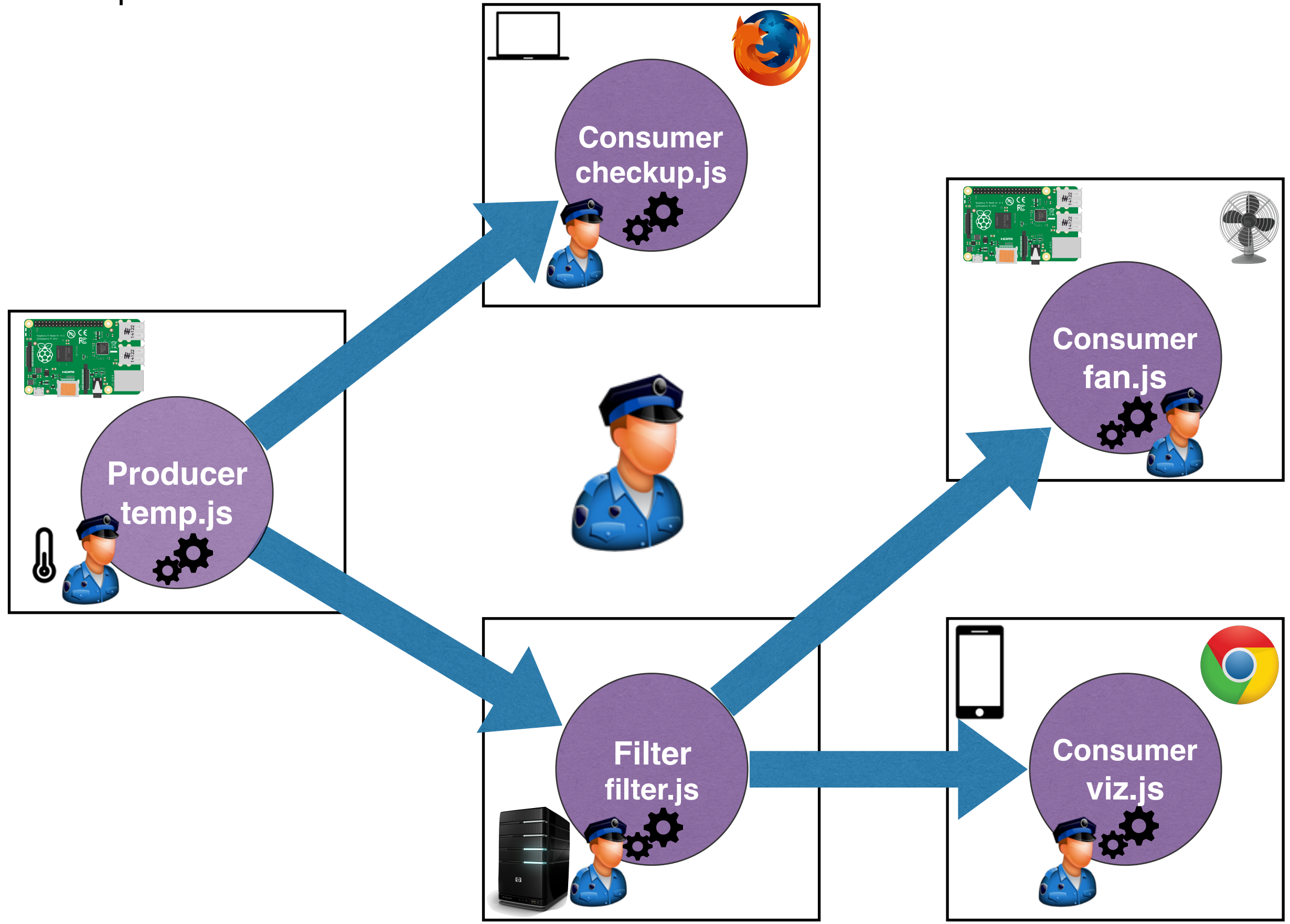
# Web Liquid Streams - Topology

```
{
  topology : {
    id : "HAS_topology",
    operators : [
      {
        id : "producer",
        script : "temp.js",
        constraints : ["temperature"],
      },
      ...
    ],
    bindings : [
      {
        from : "producer",
        to : ["filter", "web_consumer_1"]
      },
      ...
    ]
  }
}
```





# Web Liquid Streams





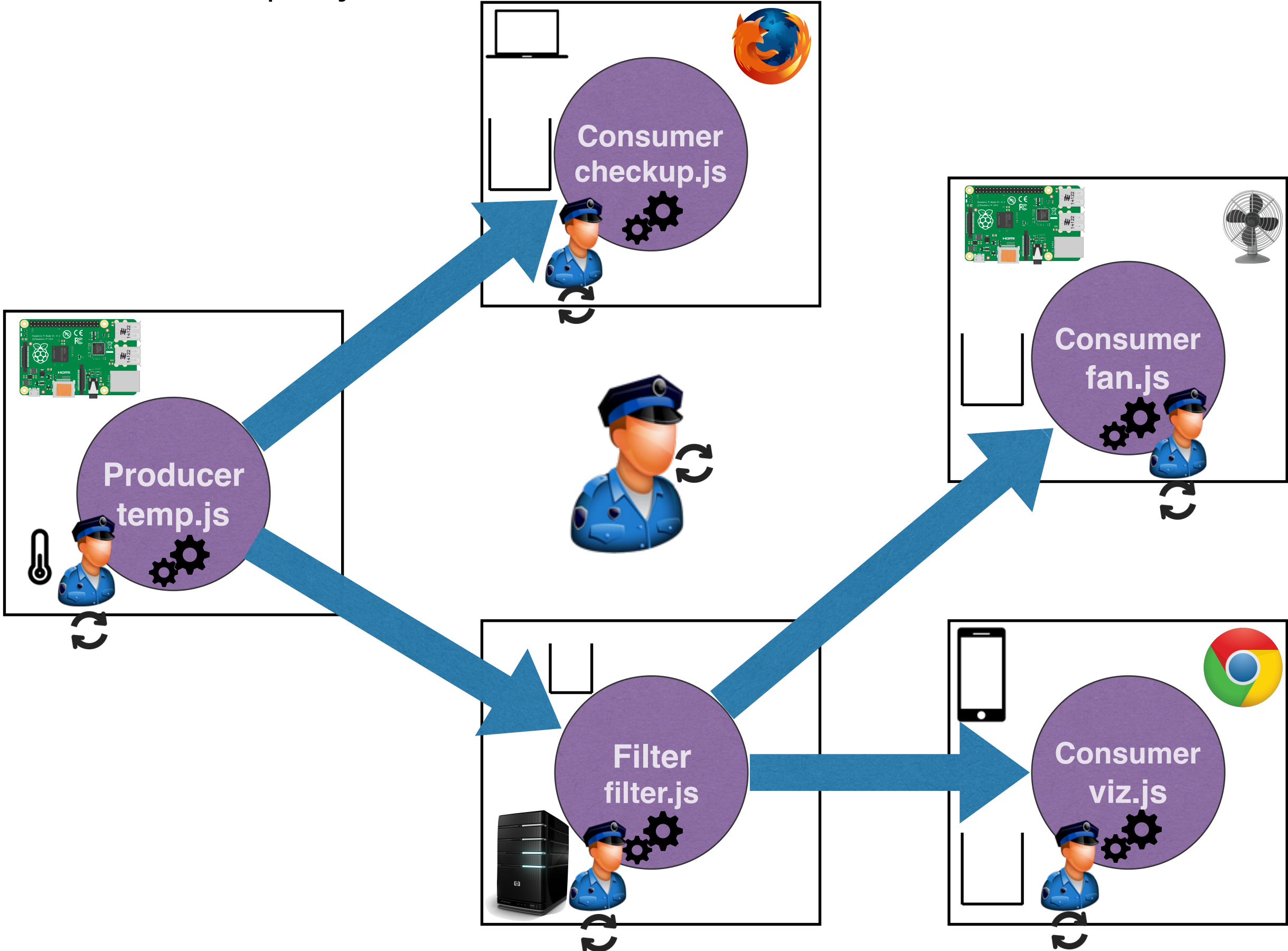
# Controller



**HTML**

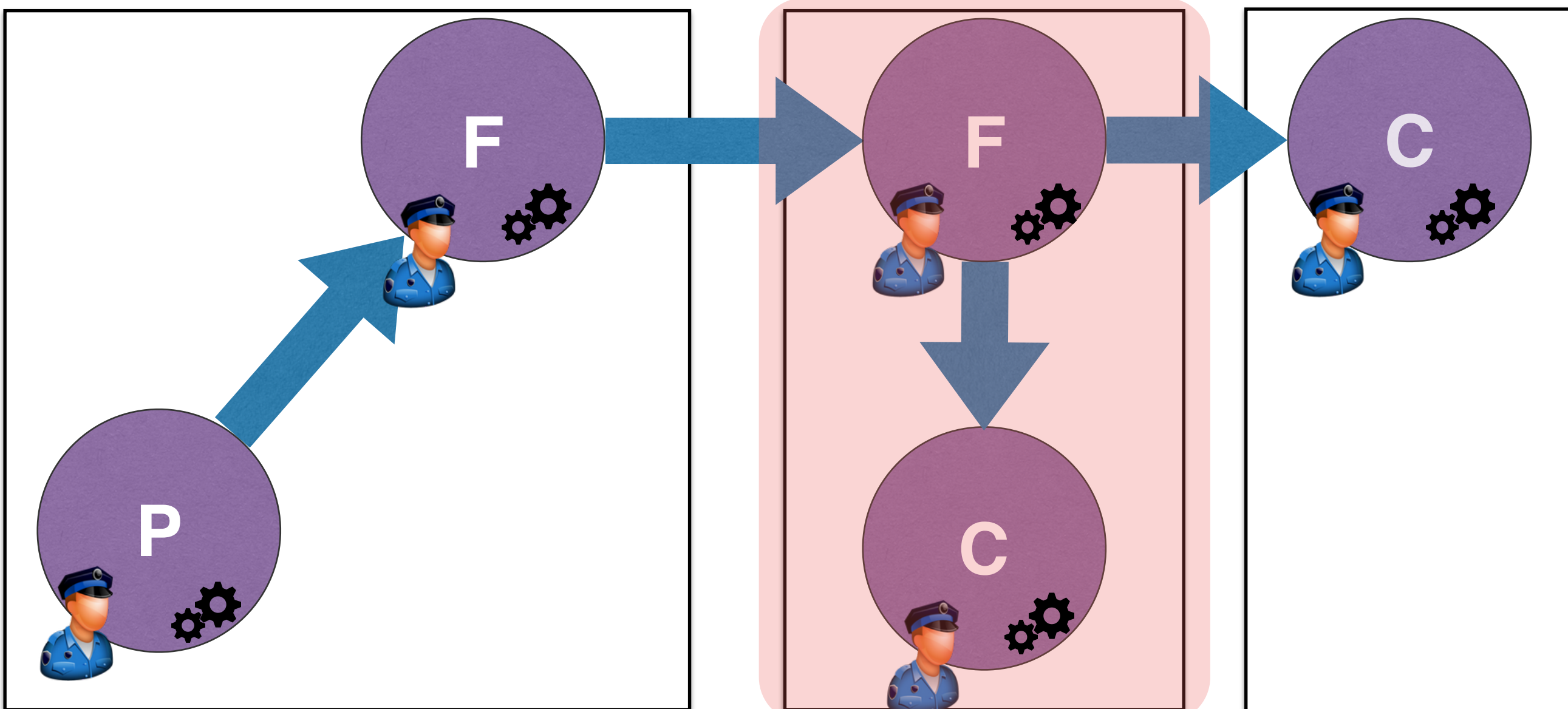


# Controller - Deployment



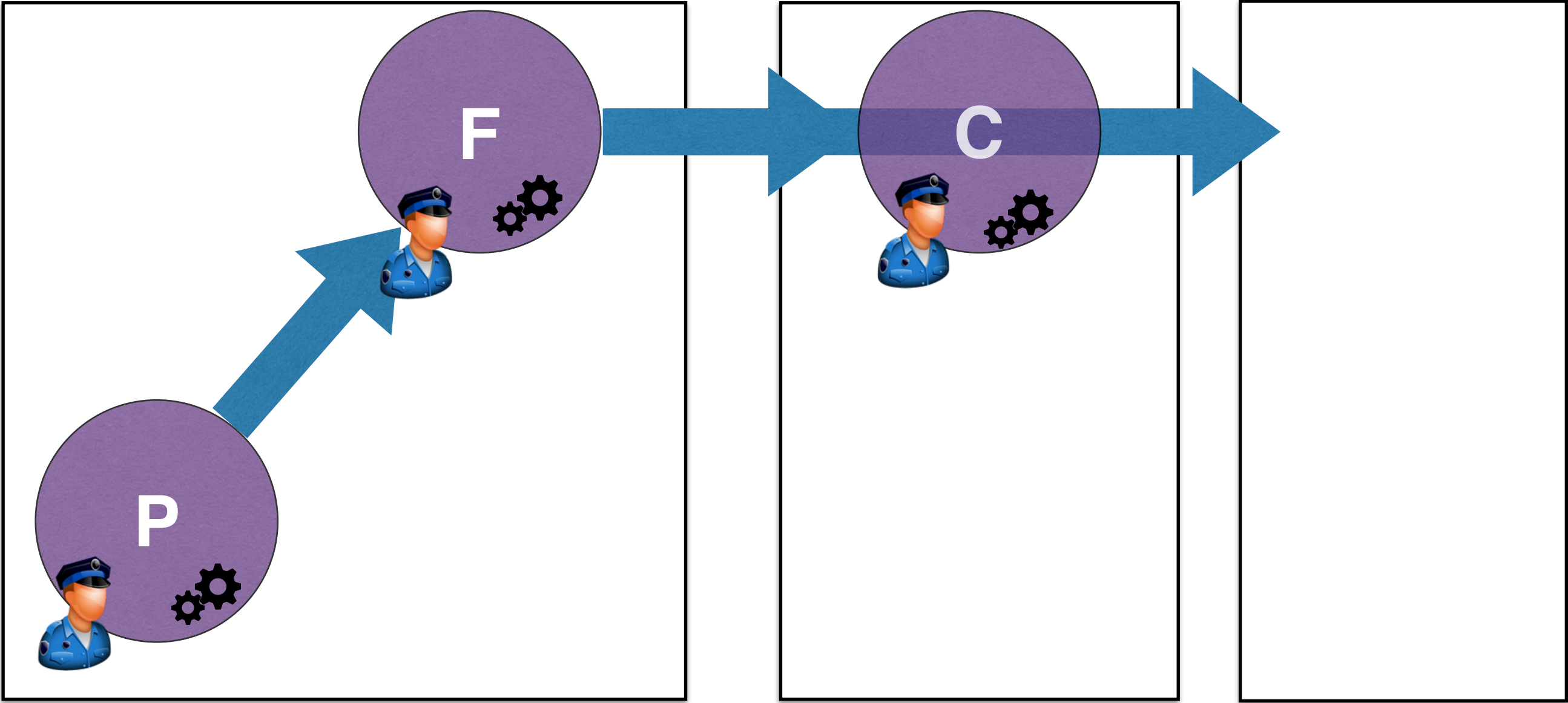
# Controller - Offloading

CPU usage == 100%

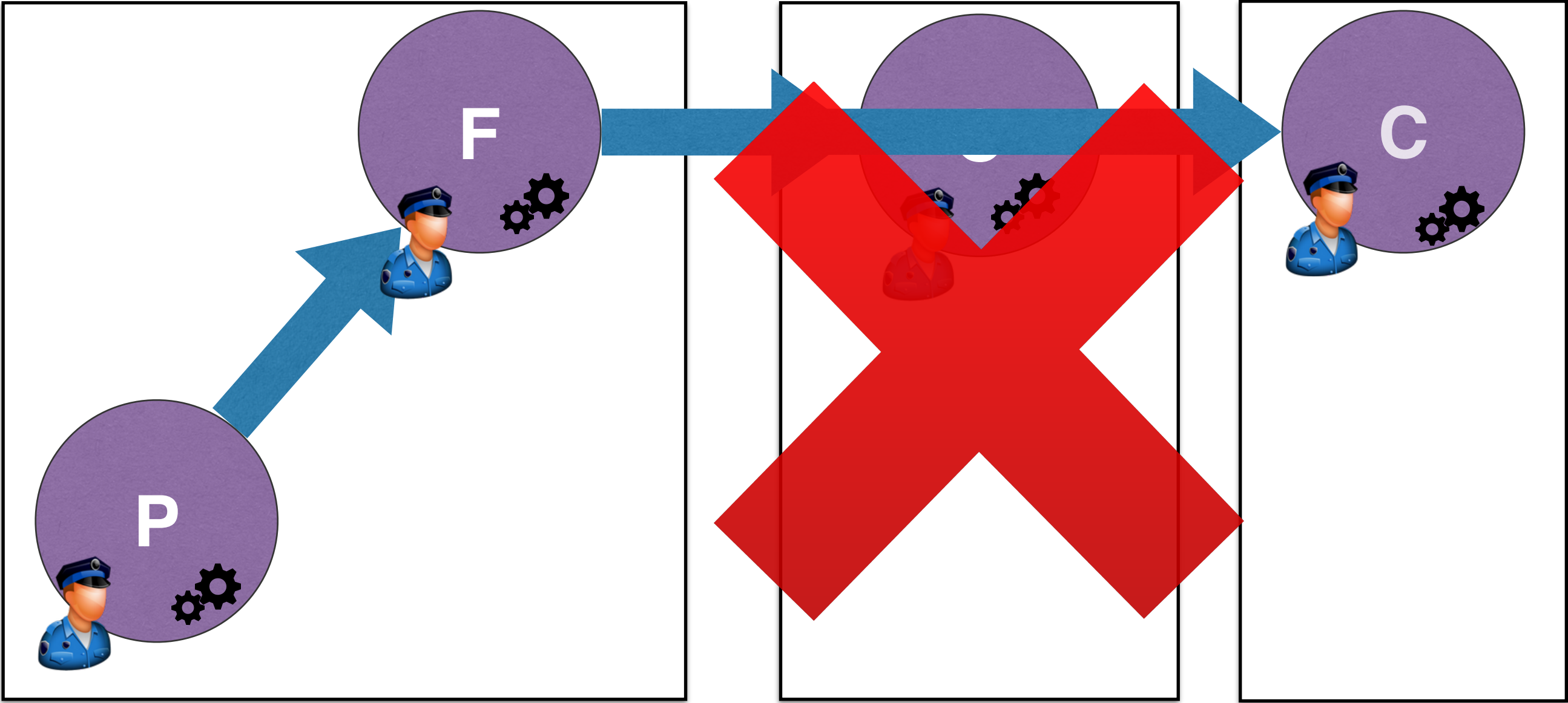




# Controller - Migration

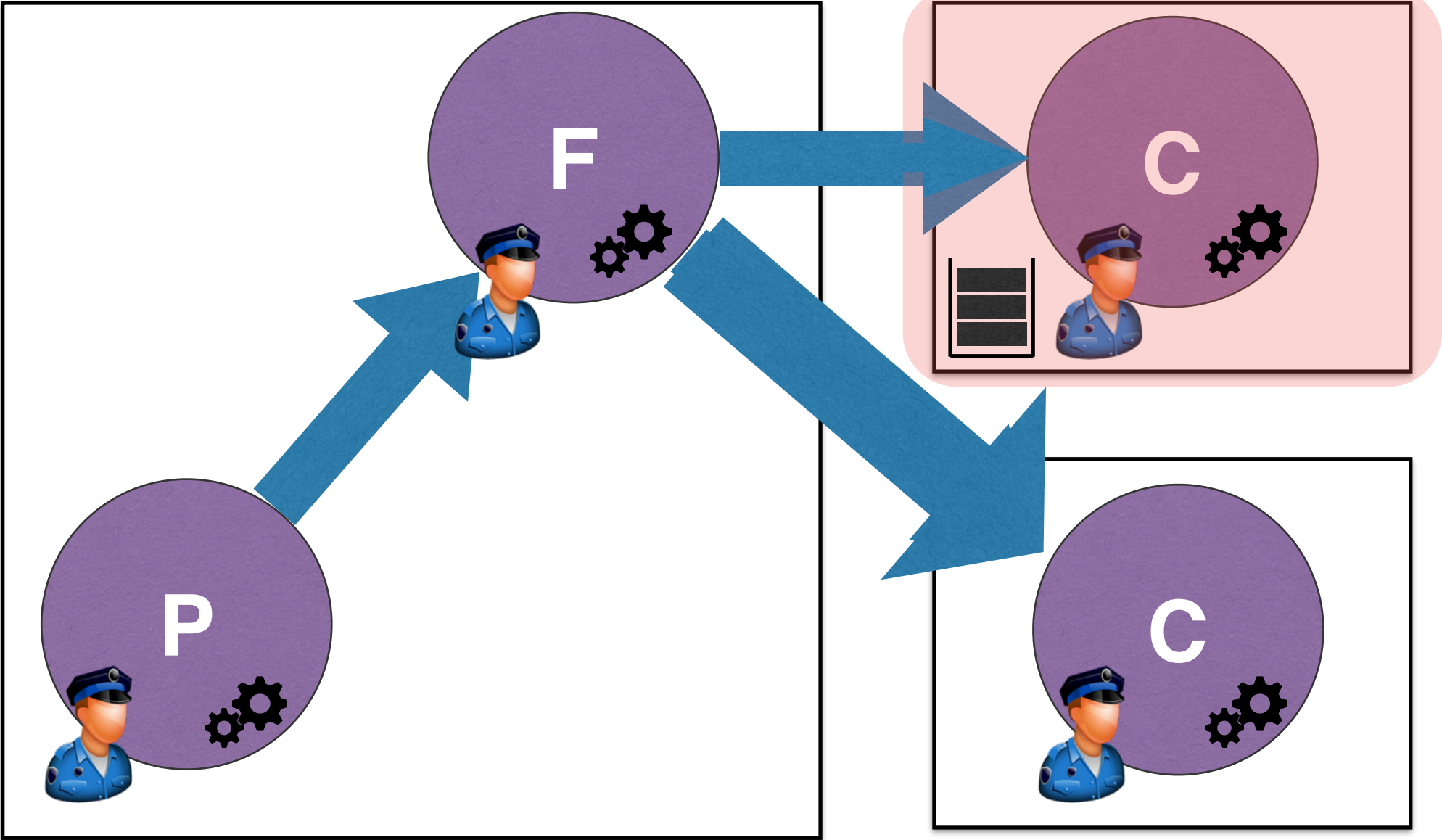


# Controller - Fault Tolerance



# Controller - Slow Mode

Queue size  $\geq 20$





# Controller - Tuning Variables



- Controller Loop Frequency
- CPU Overload Threshold
- Slow Mode Threshold

# Controller - Configurations

## Configuration 1 (C1)

- Loop: 500ms
- $T_{CPU}$ : 100%
- Slow Mode:
  - $T_{qh}$ : 20
  - $T_{ql}$ : 10

## Configuration 2 (C2)

- Loop: 300ms
- $T_{CPU}$ : 100%
- Slow Mode:
  - $T_{qh}$ : 20
  - $T_{ql}$ : 10



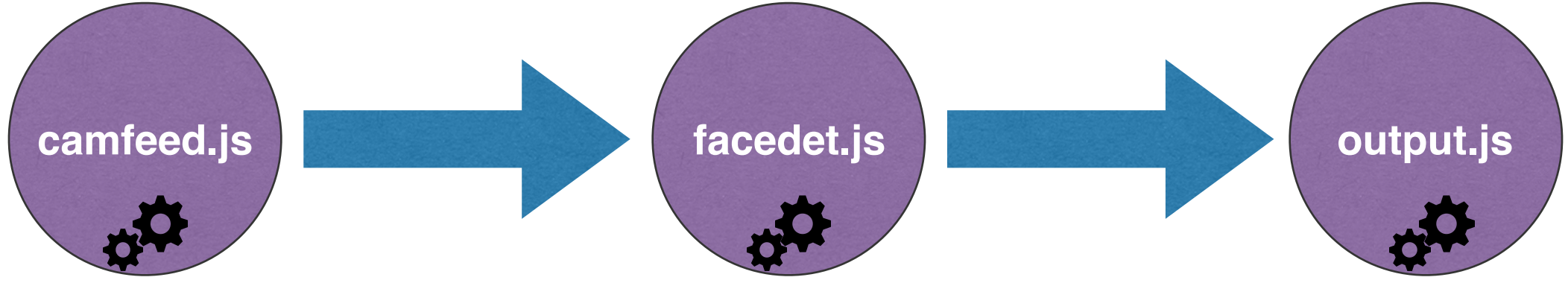
## Configuration 3 (C3)

- Loop: 300ms
- $T_{CPU}$ : 50%
- Slow Mode:
  - $T_{qh}$ : 20
  - $T_{ql}$ : 10

## Configuration 4 (C4)

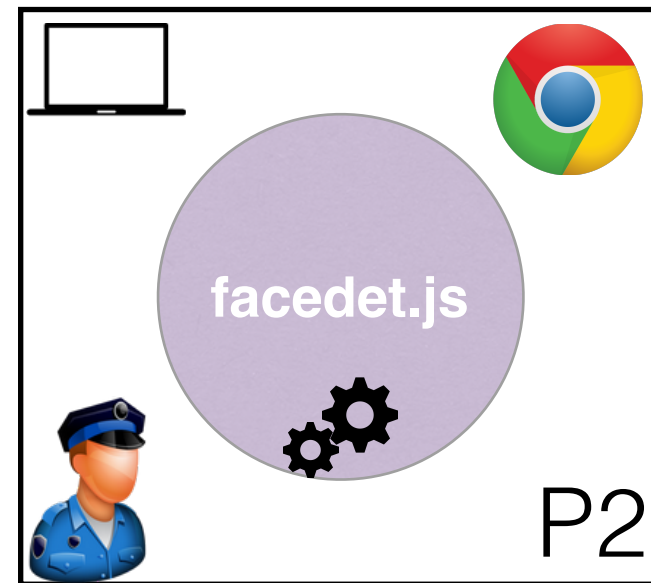
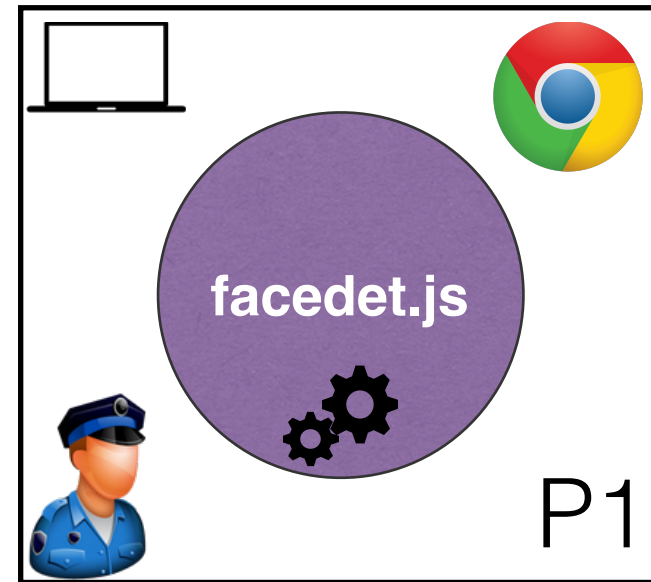
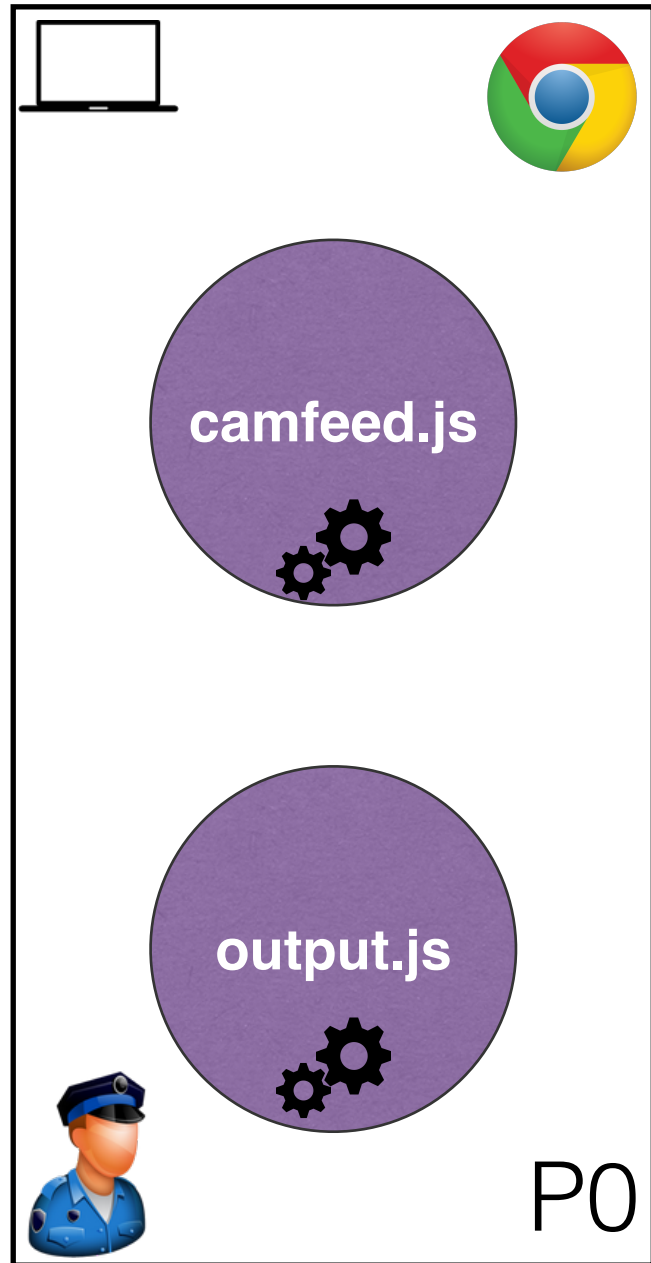
- Loop: 300ms
- $T_{CPU}$ : 50%
- Slow Mode:
  - $T_{qh}$ : 10
  - $T_{ql}$ : 5

# Experiment - Use Case Scenario





# Experiment - Use Case Scenario

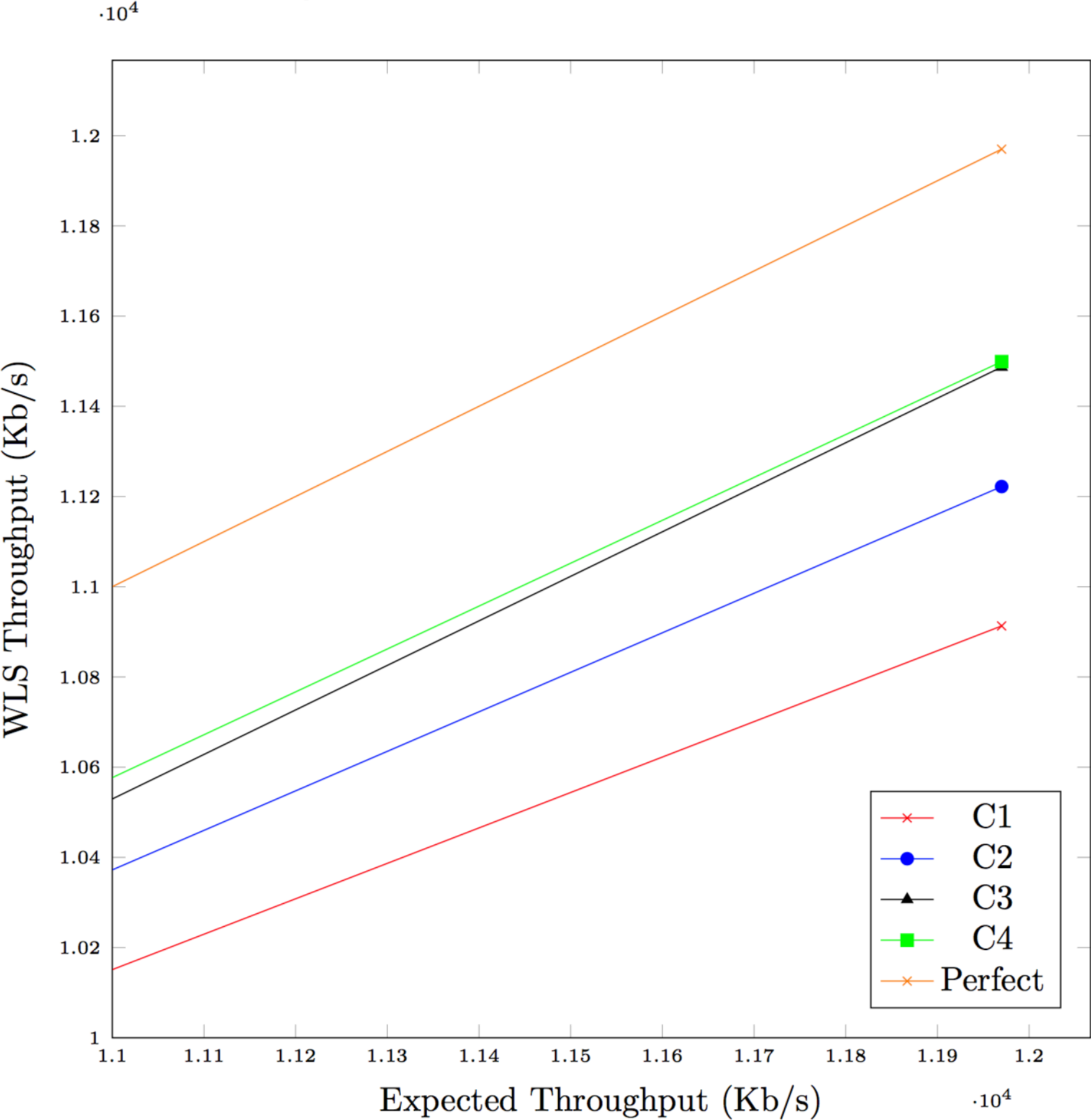


# Experiment - Use Case Scenario

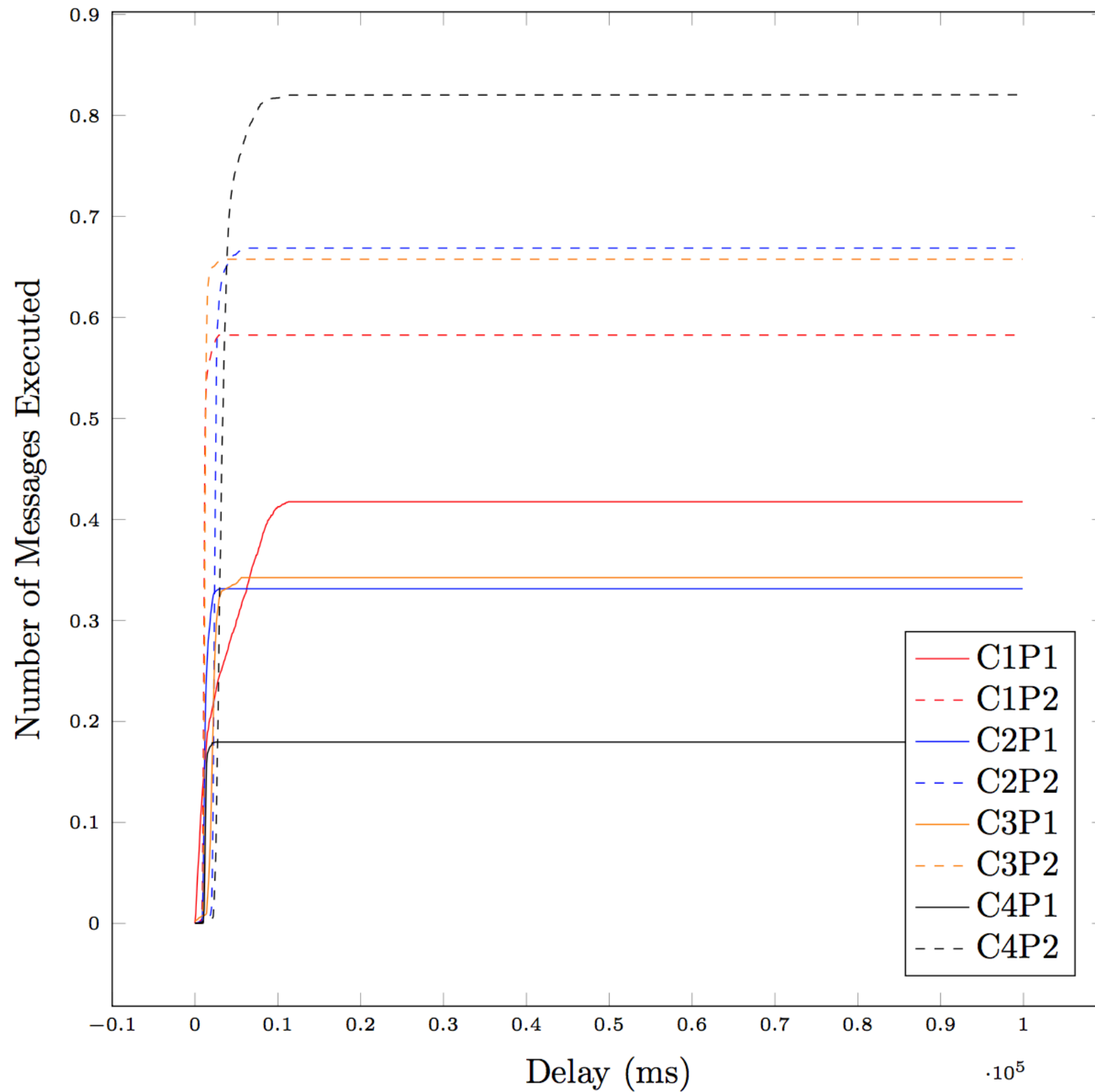


- 400x300px
- Input Throughputs:
  - 6 msg/s
  - 10 msg/s
  - 13 msg/s

# Results - Throughput

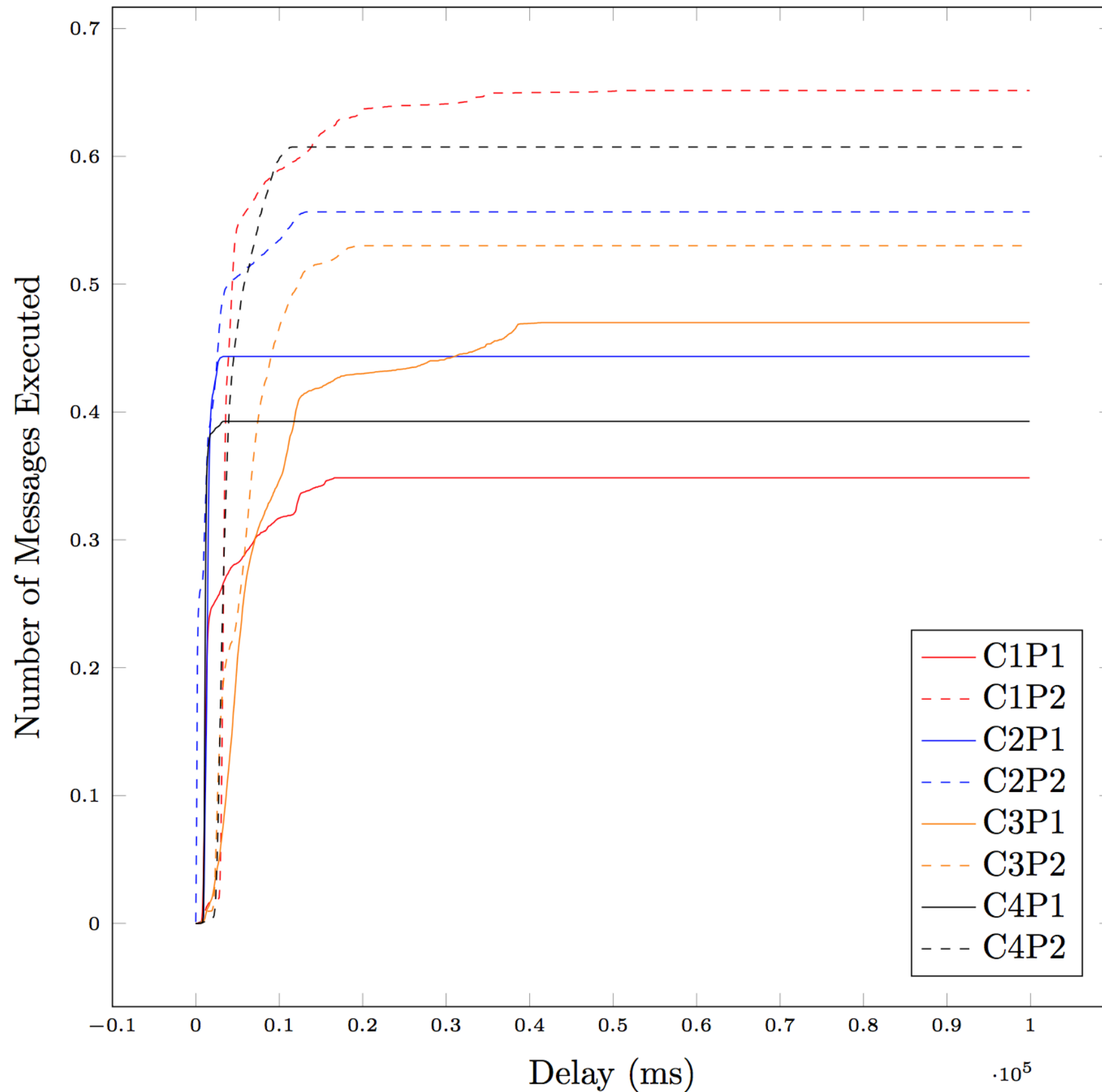


# Results - 6msq/s. Delay

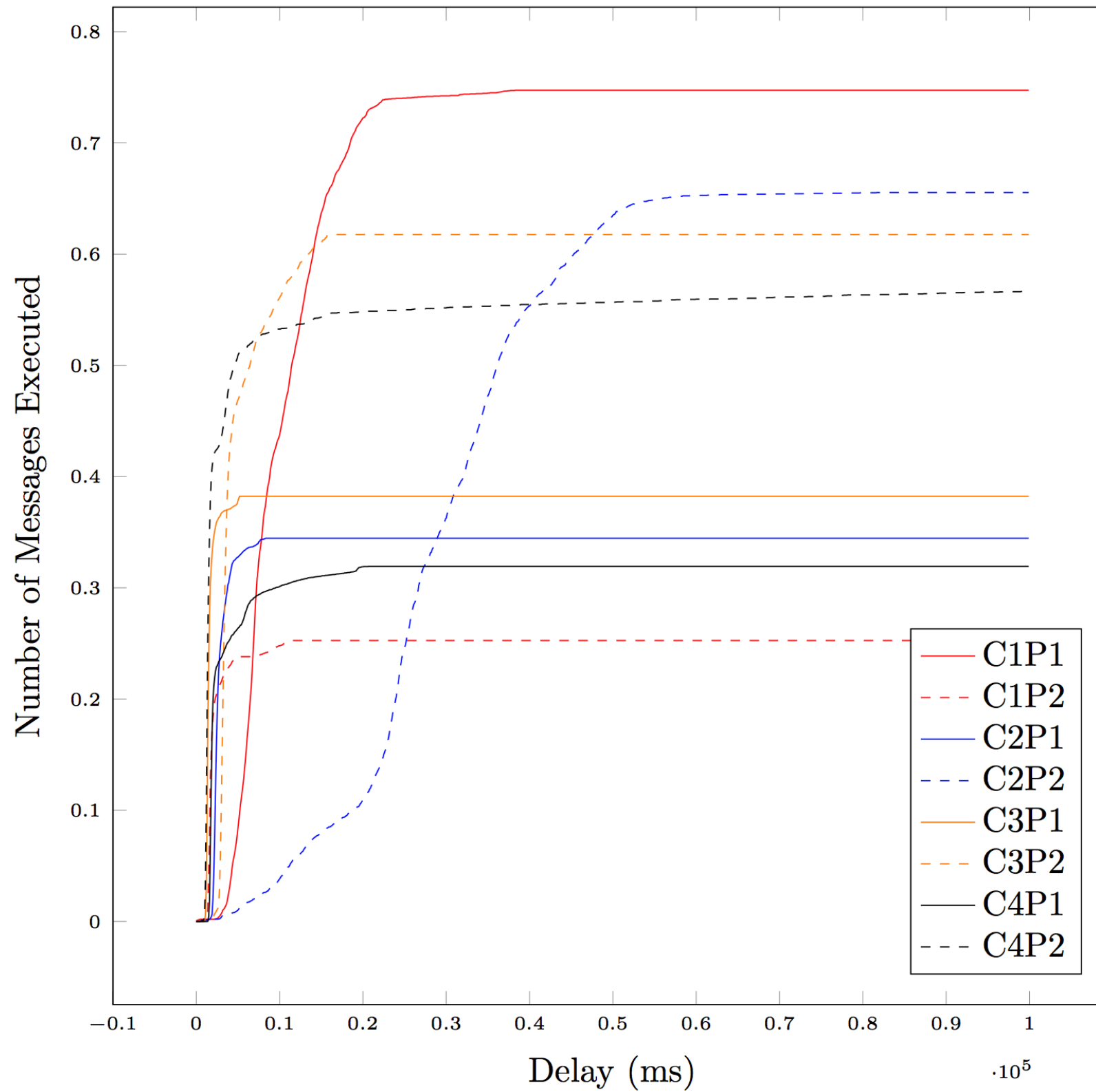




# Results - 10msg/s, Delay



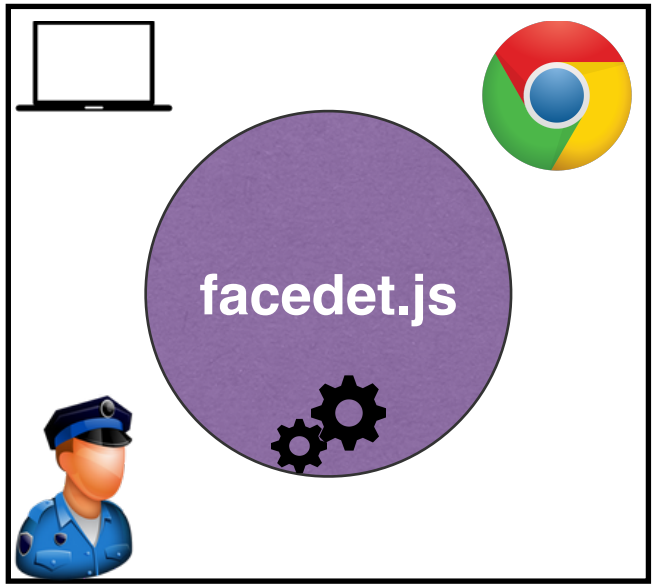
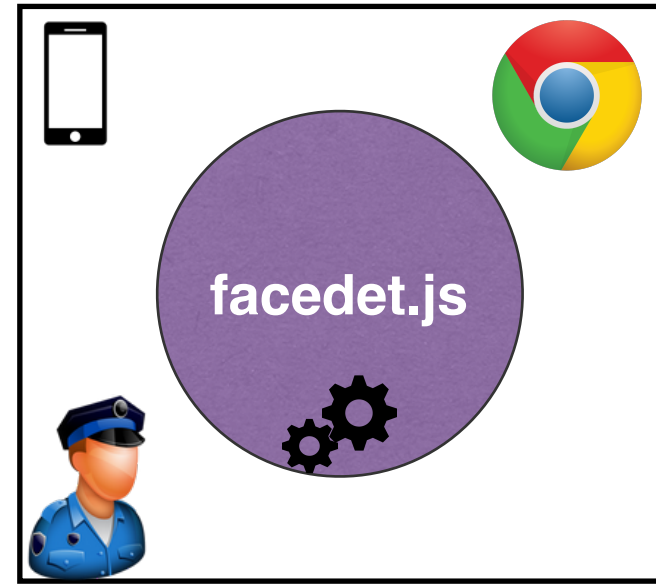
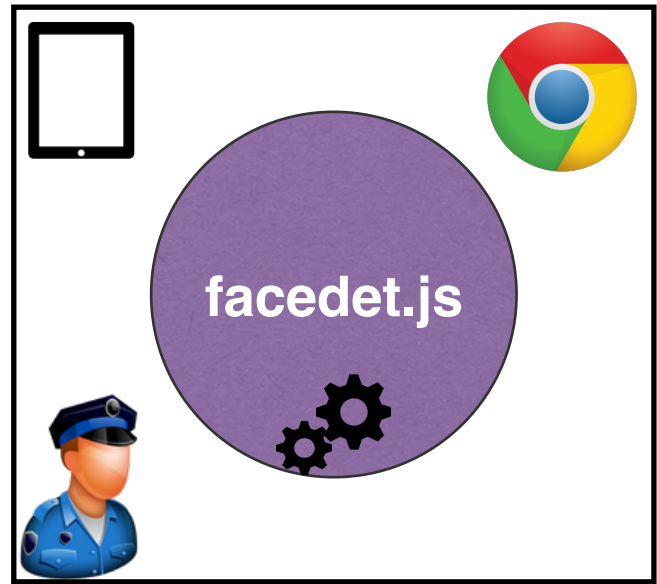
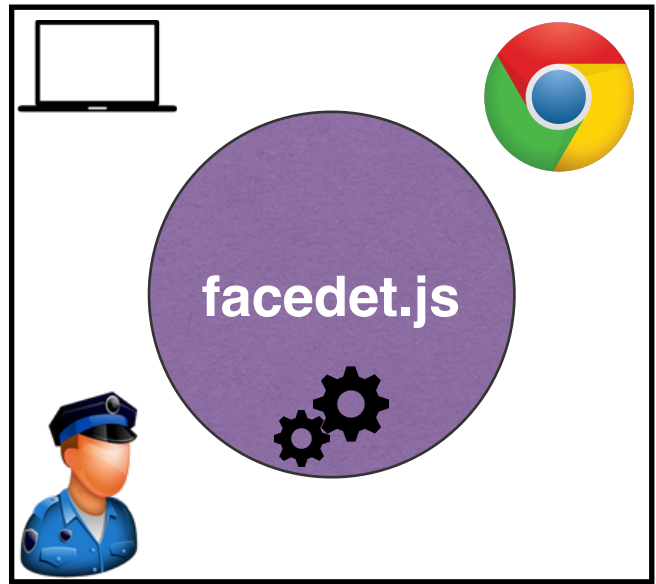
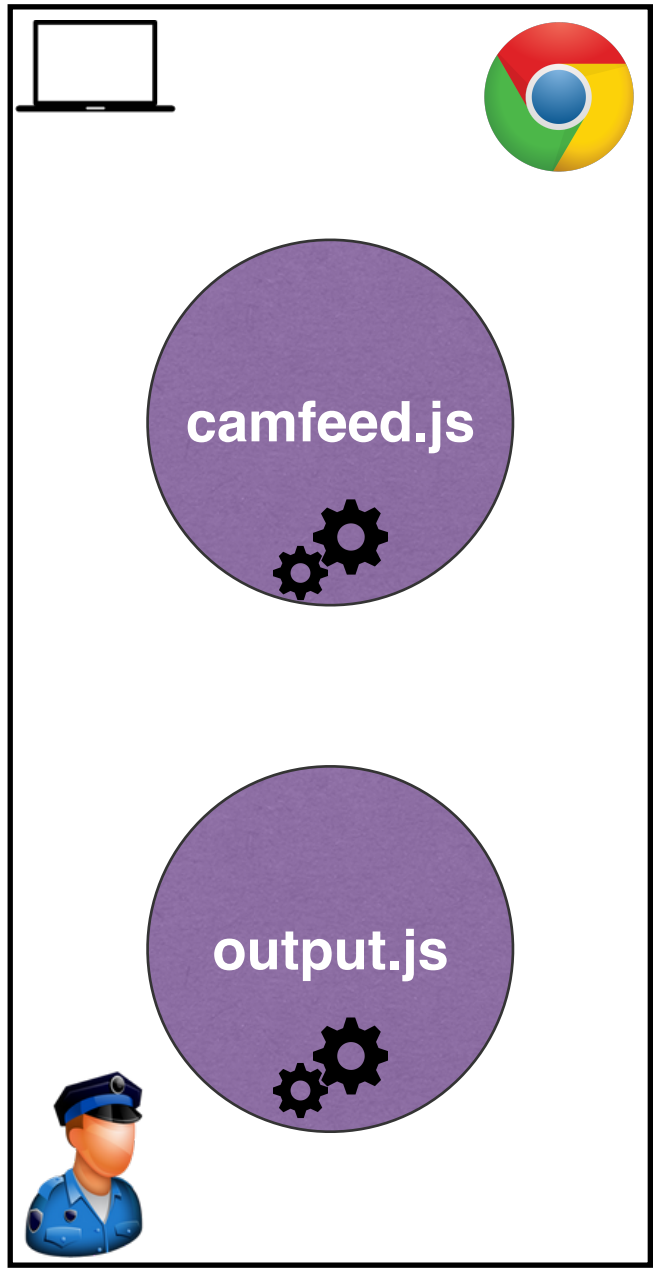
# Results - 13msg/s, Delay



# Future Work



# Future Work - Heterogeneous Devices

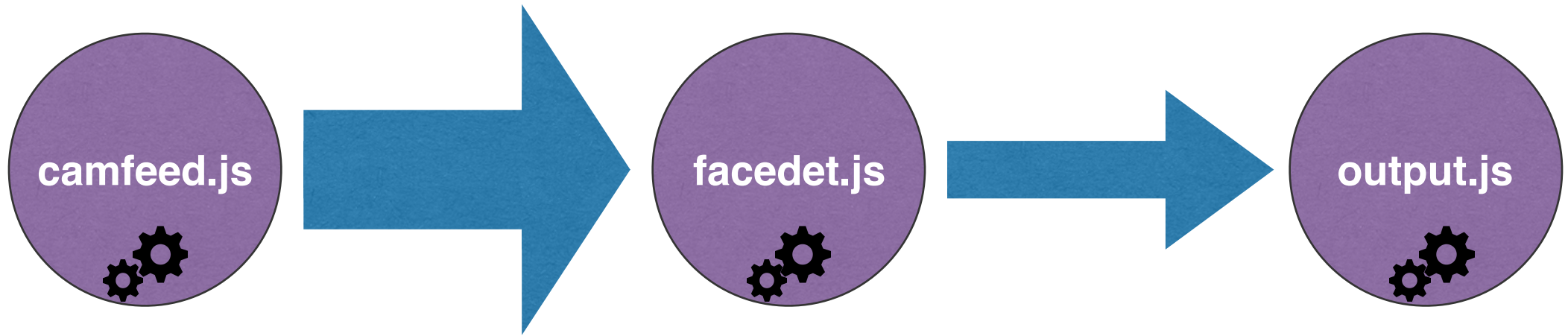




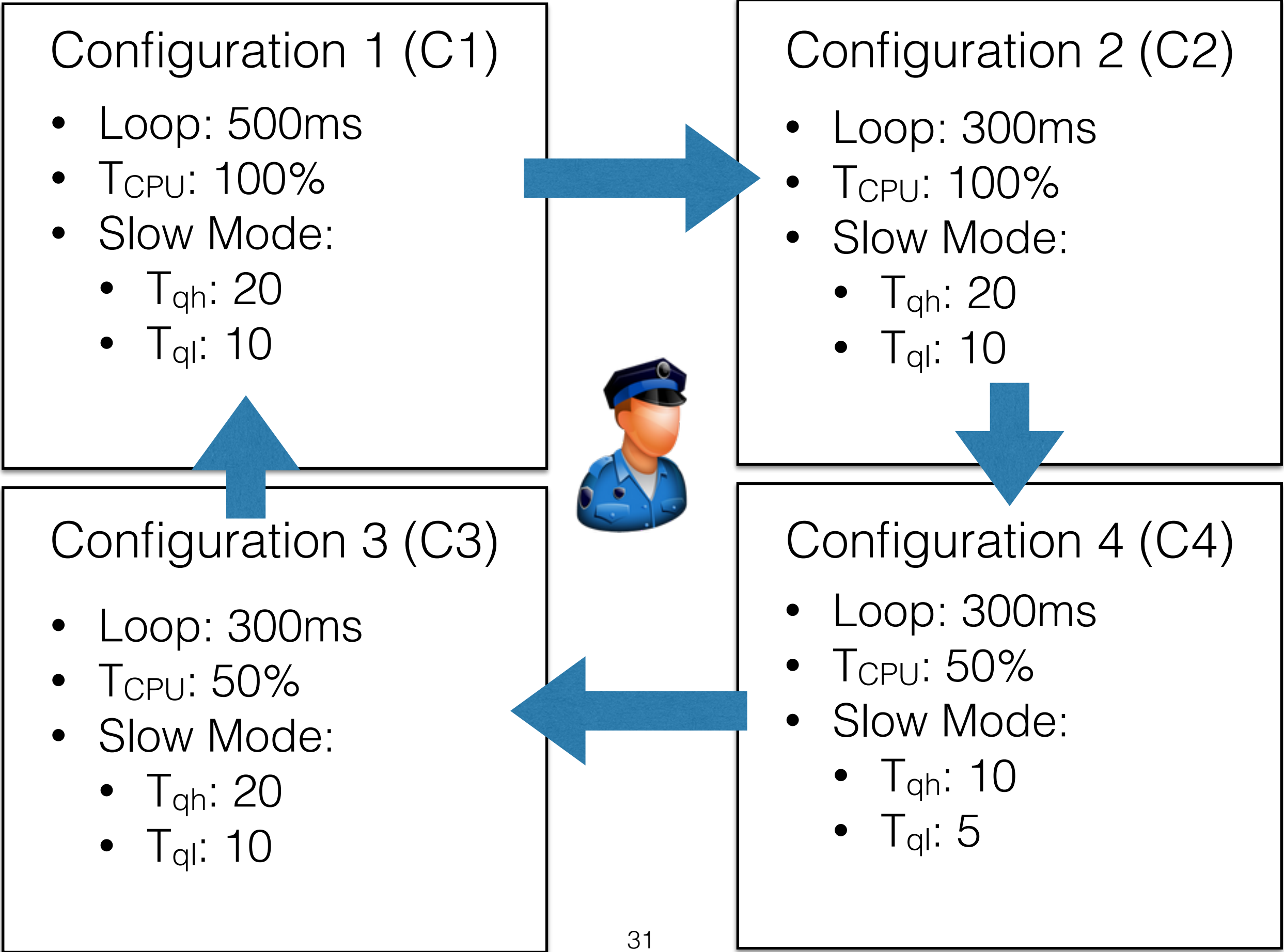
# Future Work - Controller Comparison

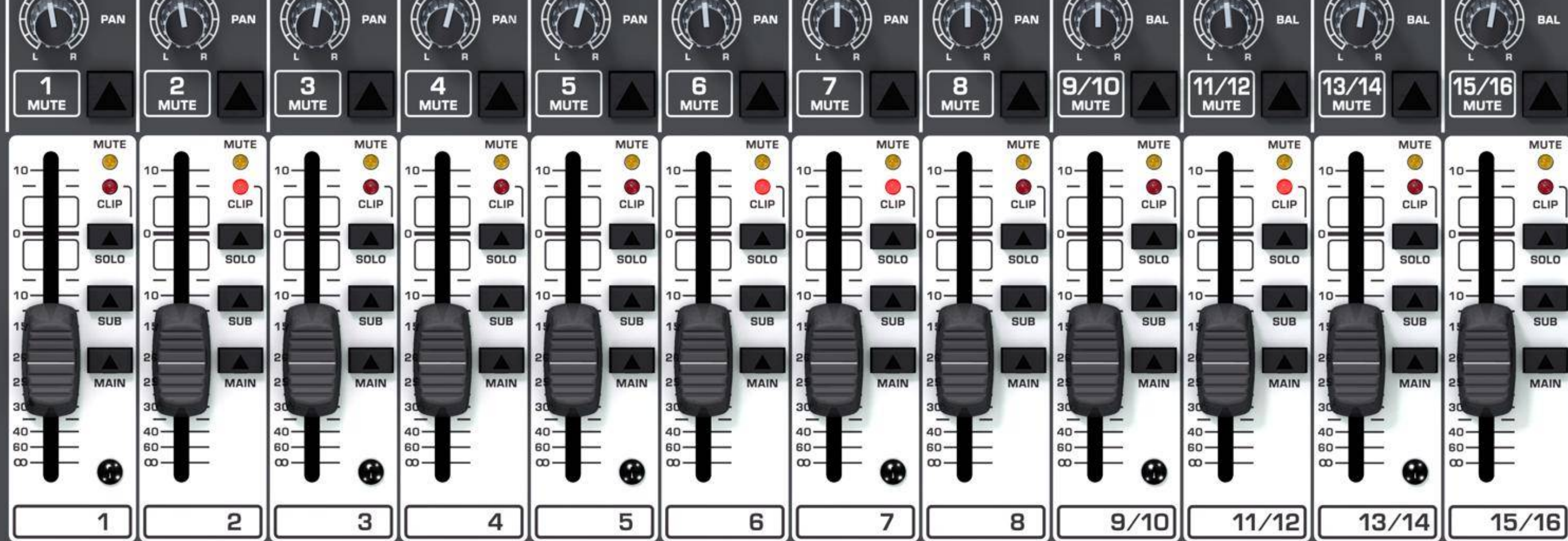


# Future Work - Mutating Workloads



# Future Work - Autonomous Controller Policy





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<https://github.com/masiarb/Web-Liquid-Streams>