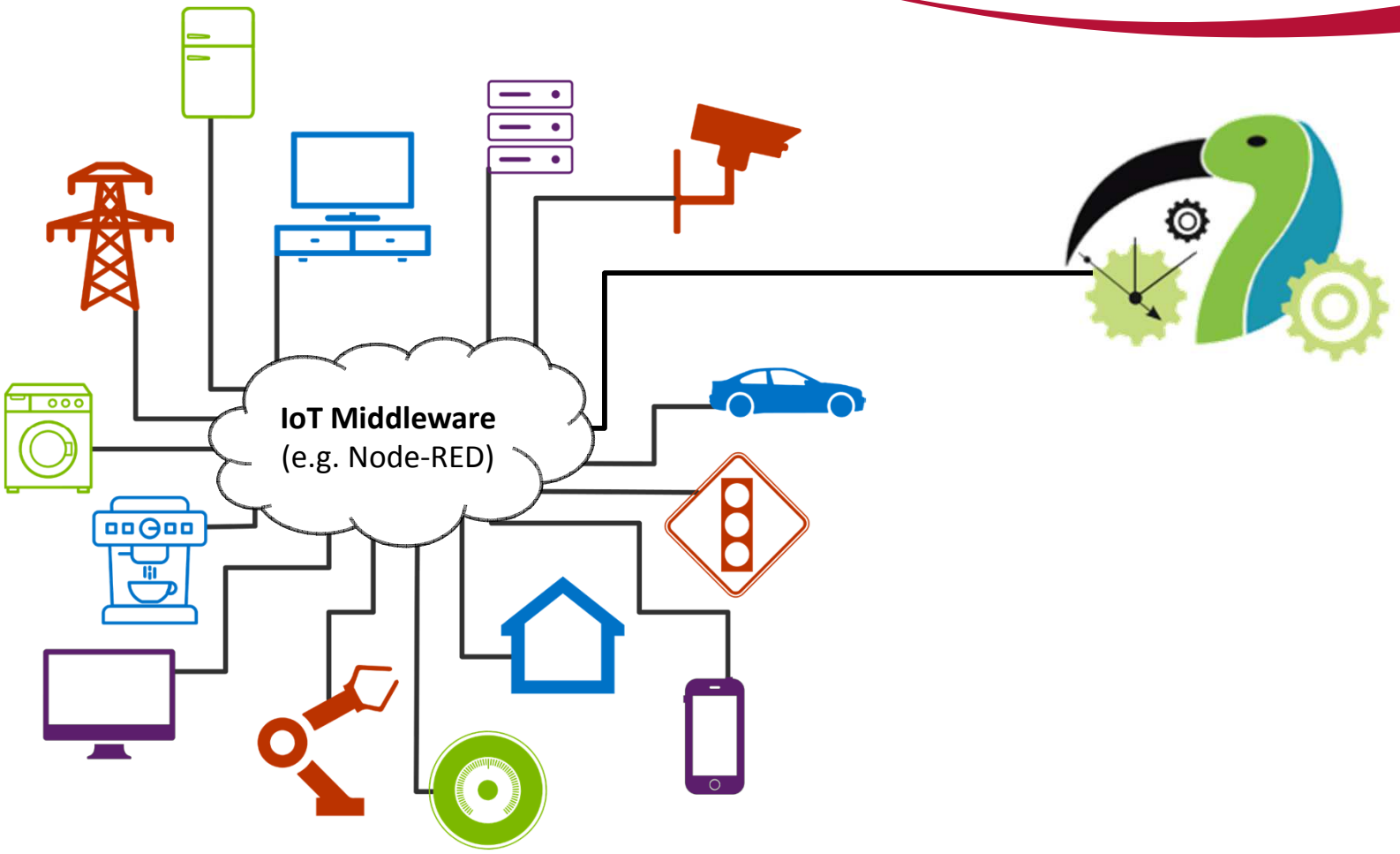
Enabling Papyrus-RT for the Internet of Things

Karim Jahed

Motivation



original image source: http://dawnbit.com

MQTT

- The MQ Telemetry Transport protocol is a lightweight publish/subscribe protocol
- ISO / OASIS standard
- Small code base, energy efficient
- Supported by most major IoT platforms: AWS, Bluemix, Azure IoT Hub…

MQTT Basics

Topic: office/floor1/temperature

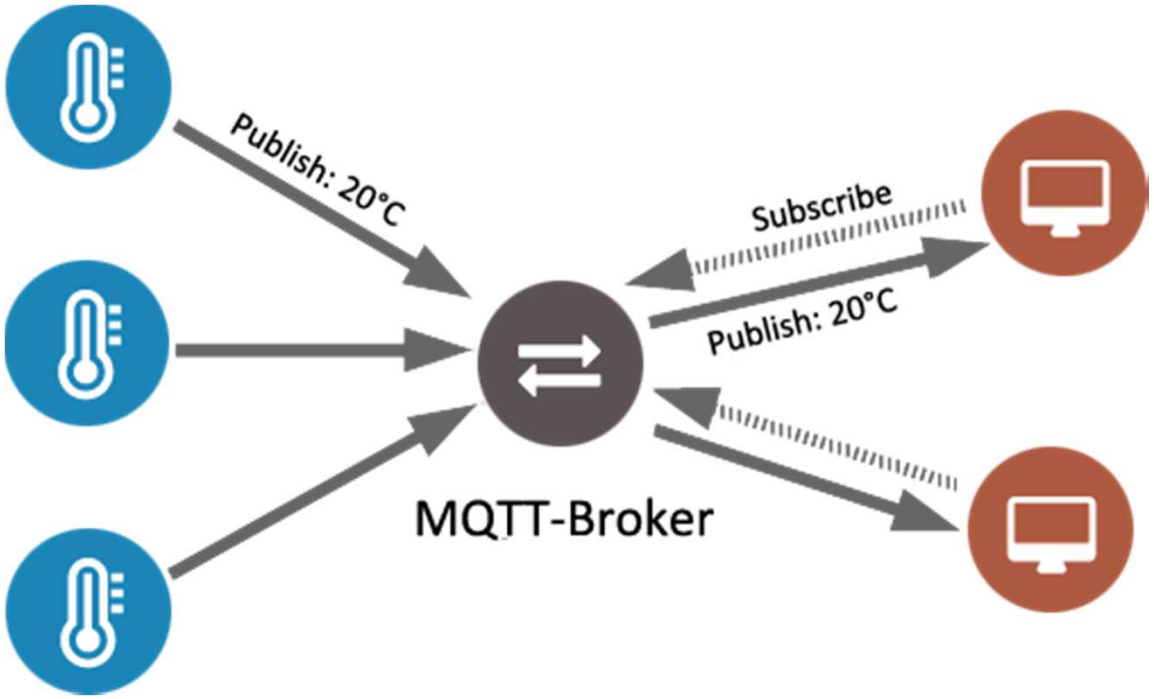
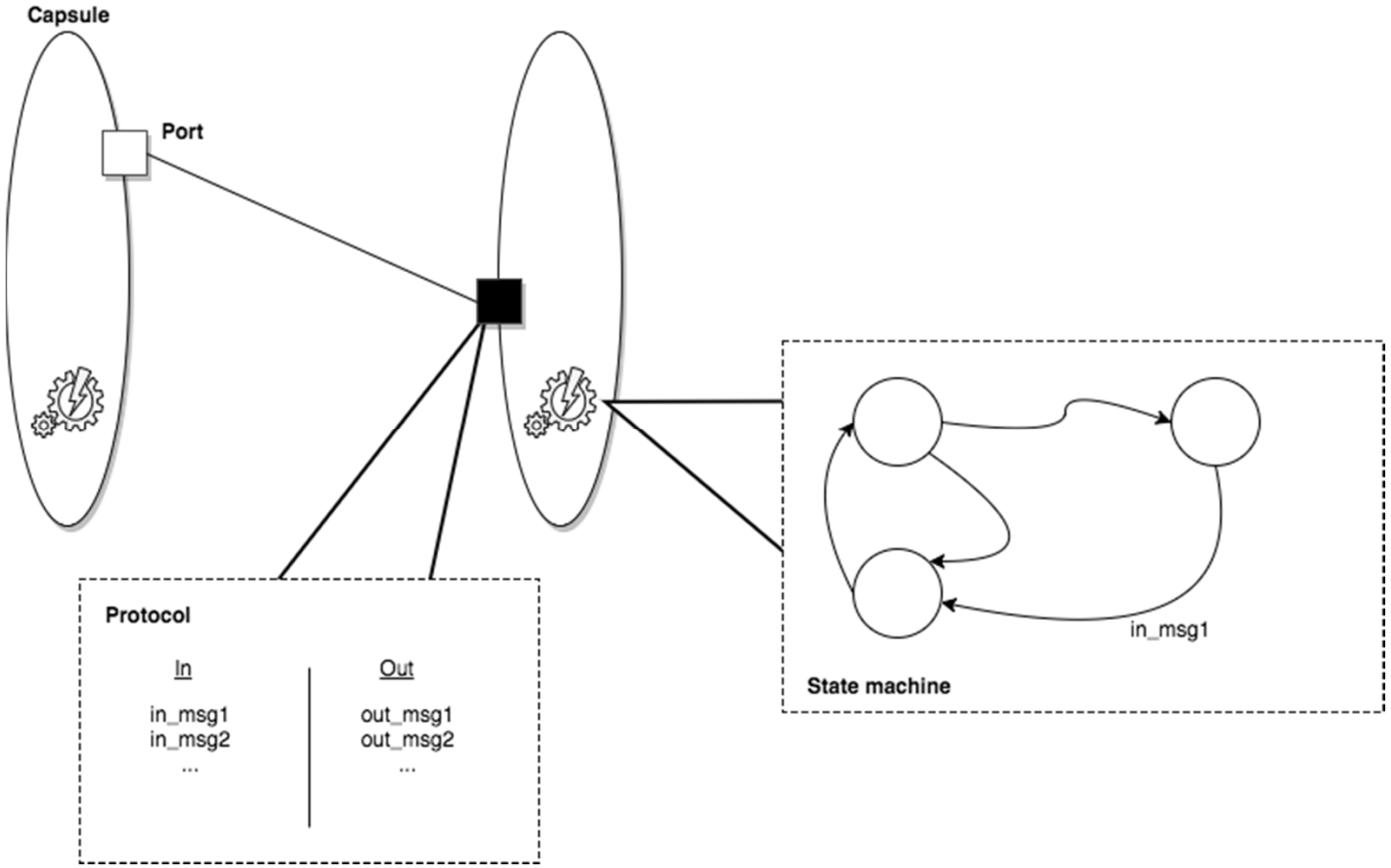
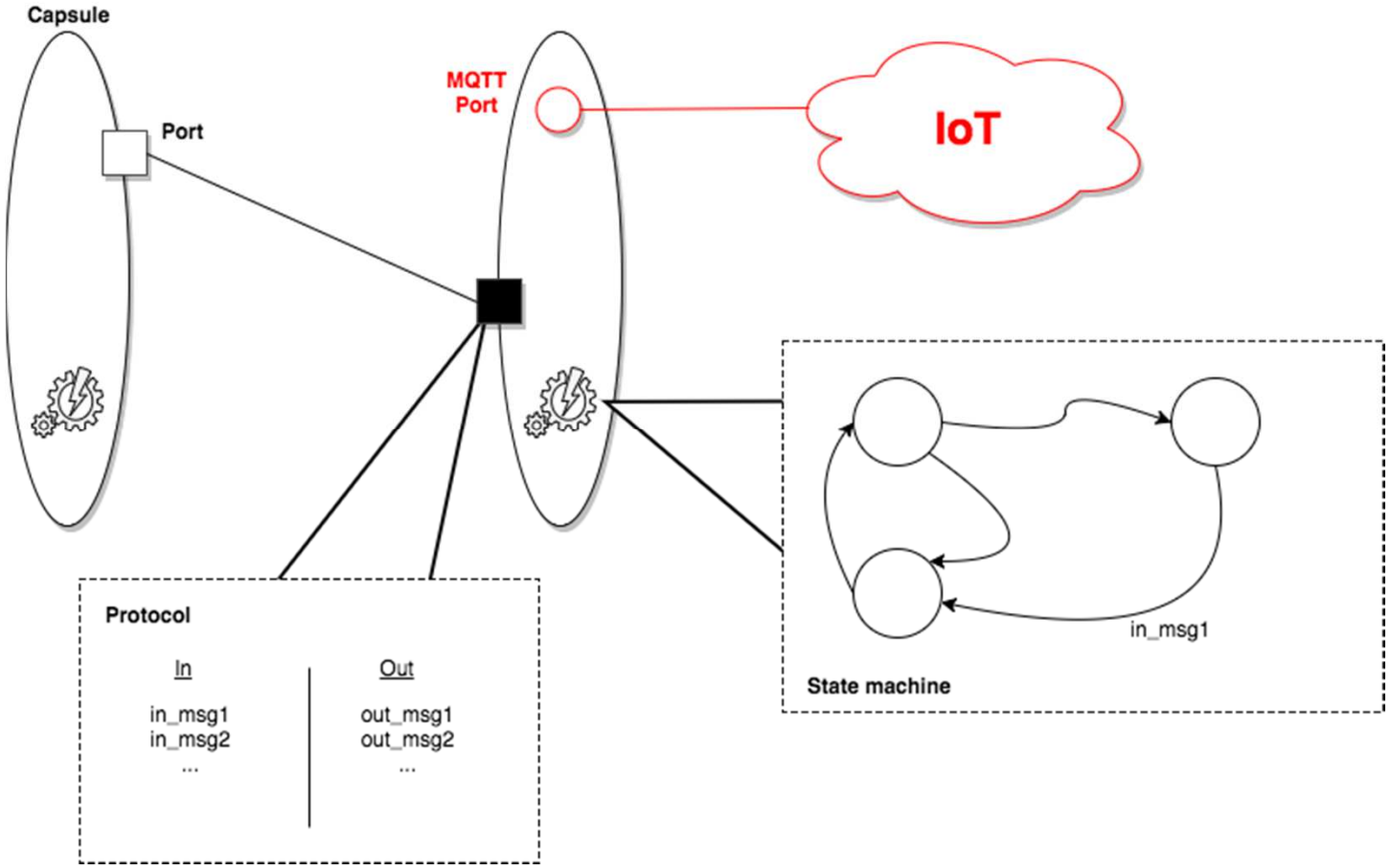


image source: http://hivemq.com

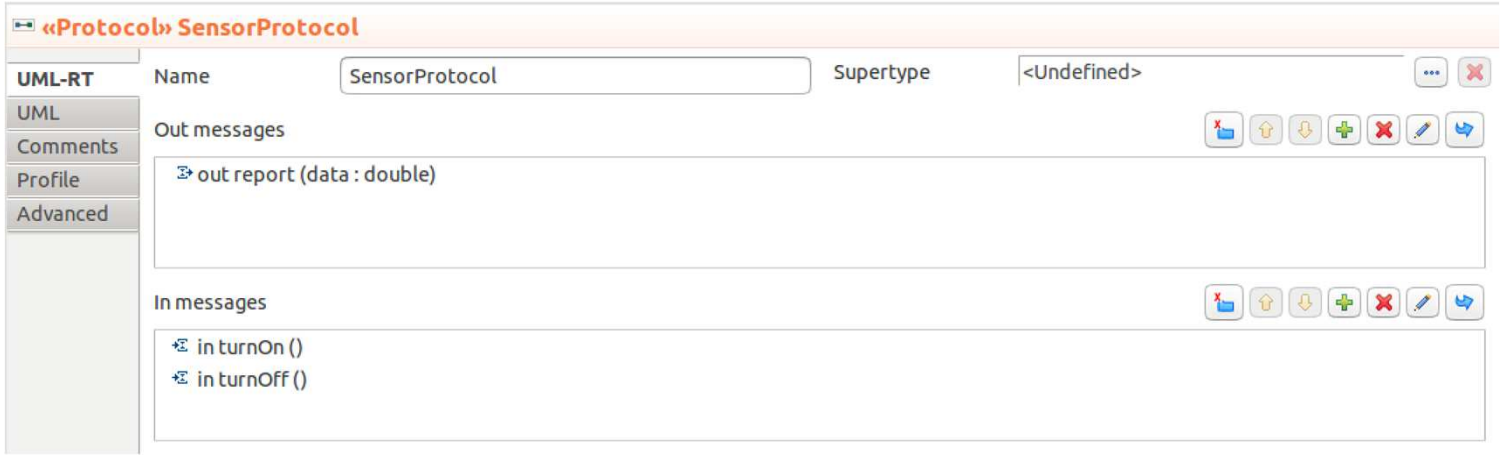
UML-RT In a Nutshell



MQTT Ports


Capsule
Port
MQTT
Port
IoT
Protocol
In
in_msg1
in_msg2
...
Out
out_msg1
out_msg2
...
in_msg1
State machine

UML-RT Protocol to MQTT Payload



report(2.5).send();

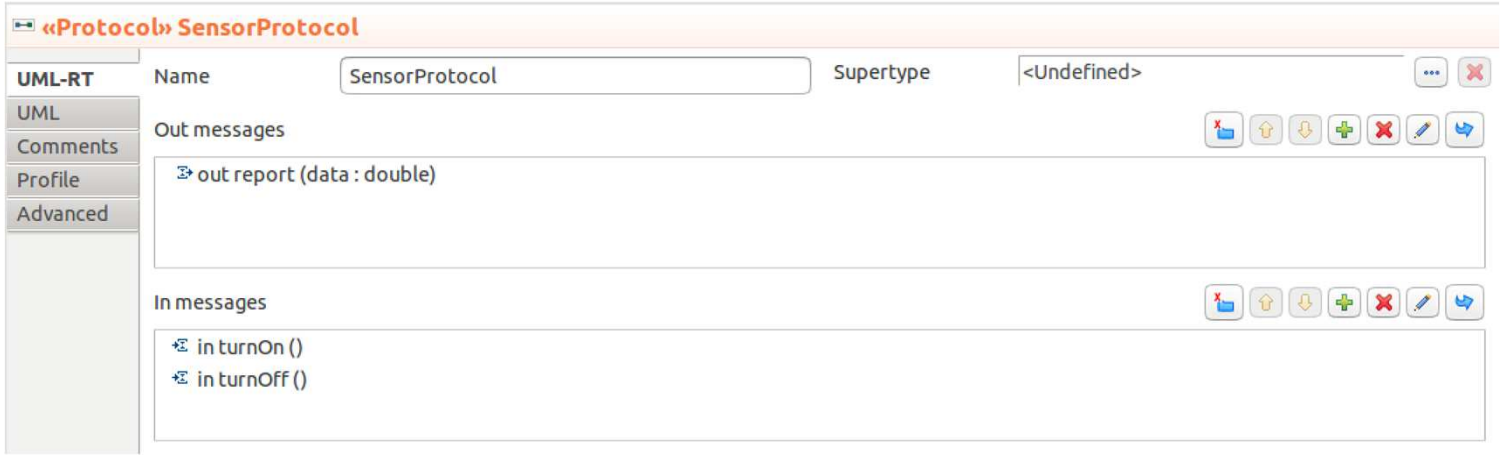
```
{
    "signal" : "report",
    "params" : [{
        "data" : 2.5
    }]
}
```

MQTT publish

Topic

SensorProtocol

UML-RT Protocol to MQTT Payload

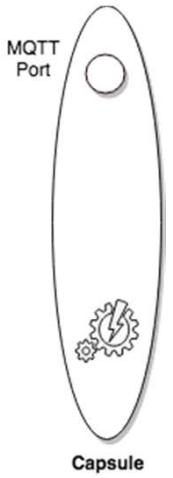


Topic

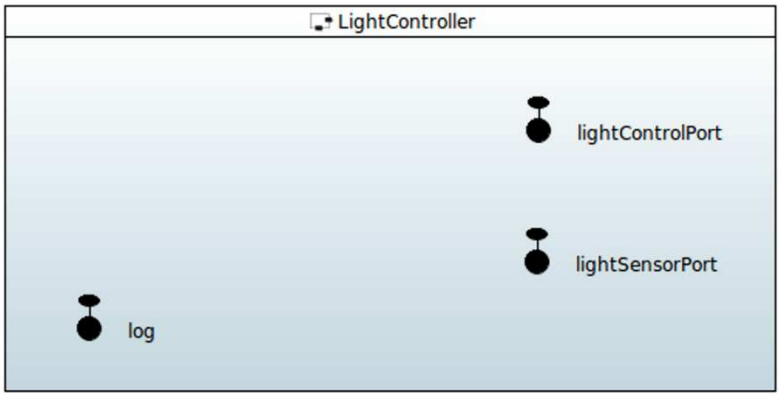
SensorProtocol

MQTT receive

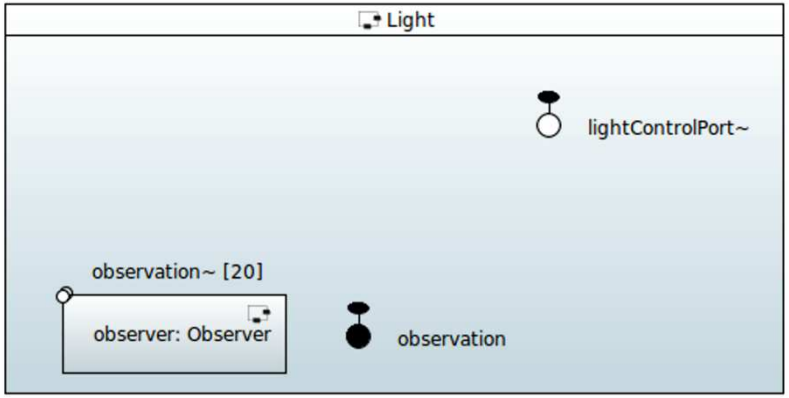
```
{
    "singal": "turnOn"
}
```



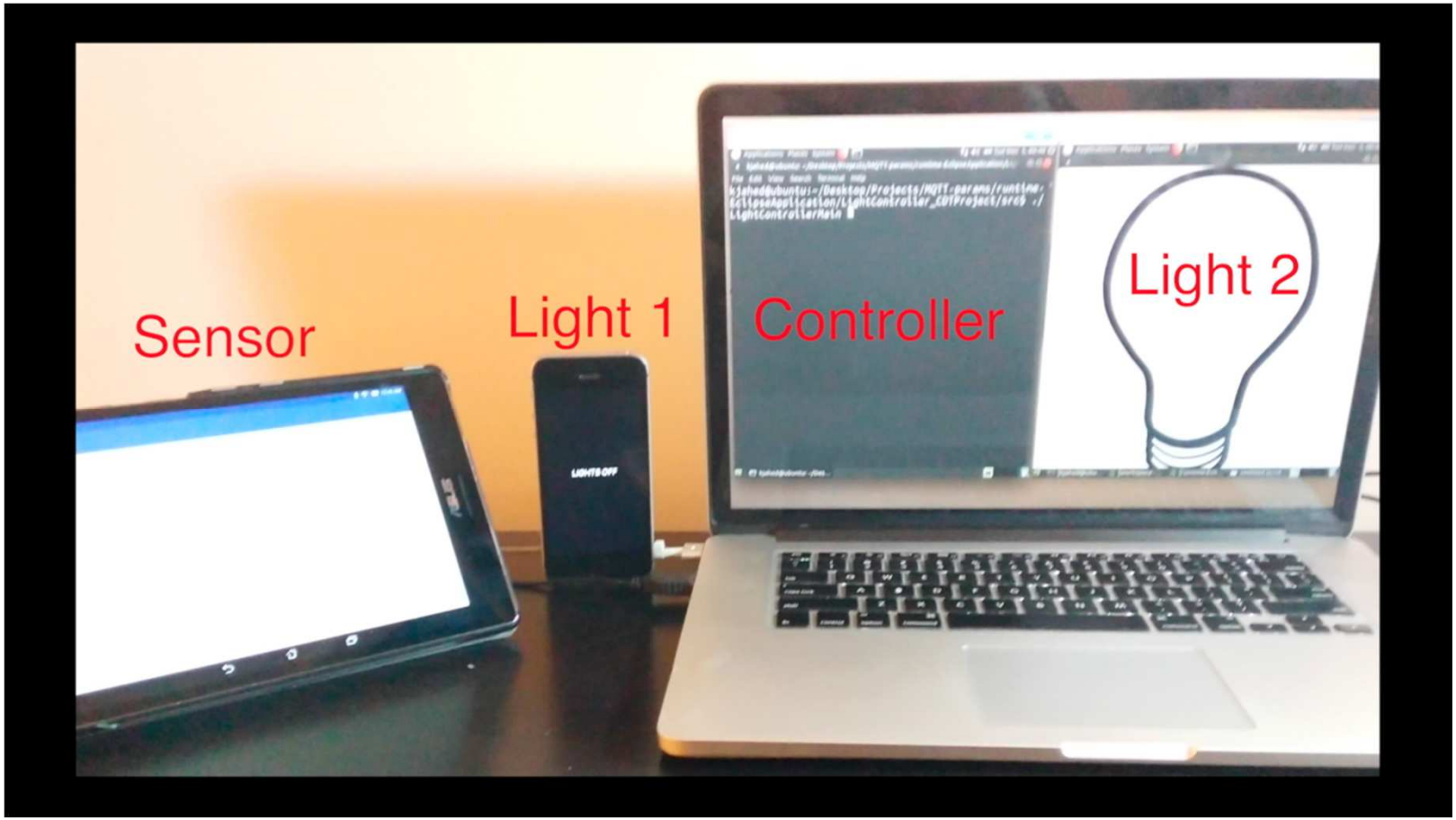
Example


LightController
lightControlPort
lightSensorPort
log

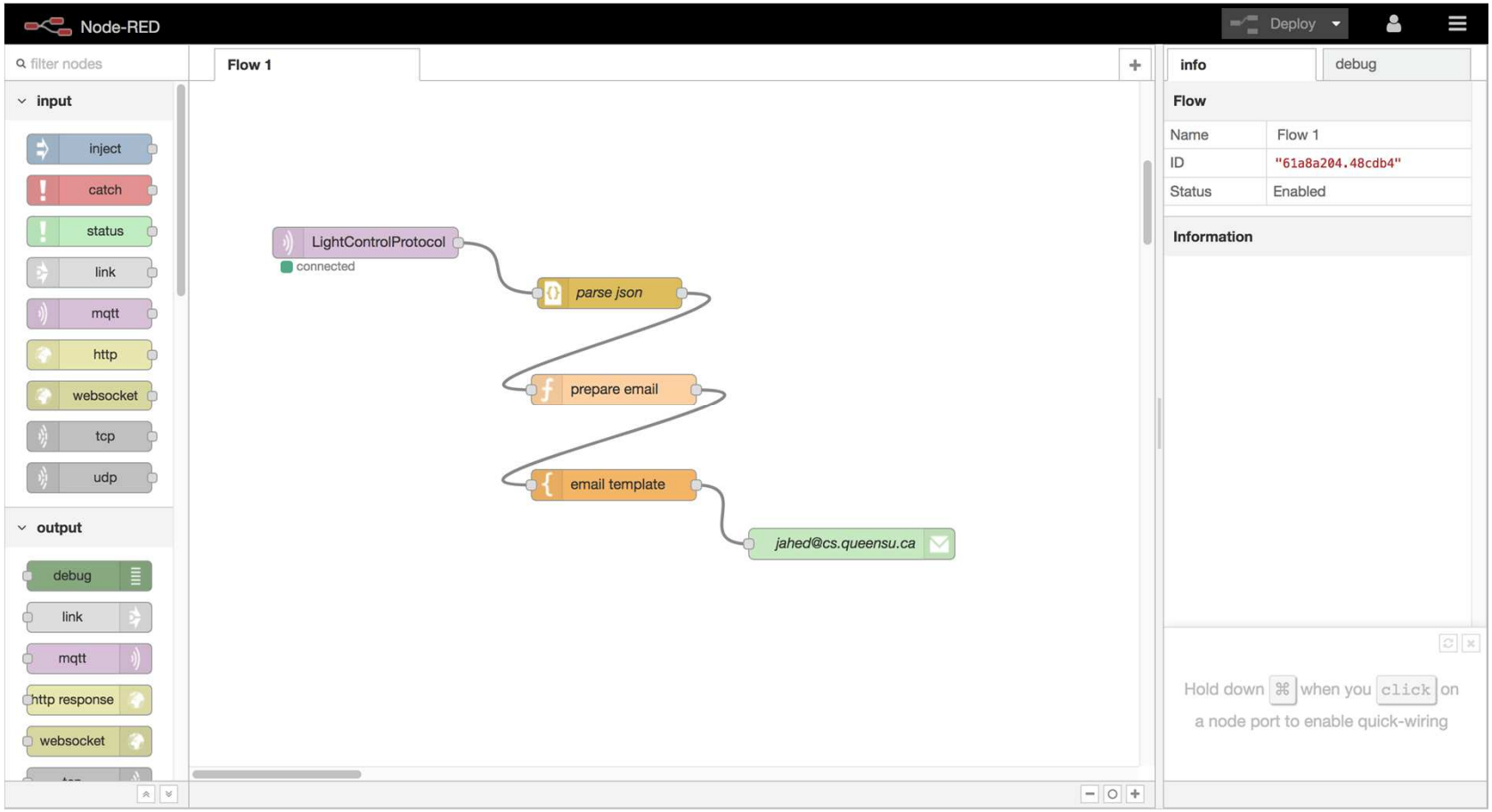

«Protocol» LightControlProtocol
out on ()
out off ()
«Protocol» LightSensorProtocol
in update (lux : float)


Light
lightControlPort~
observation~ [20]
observer: Observer
observation

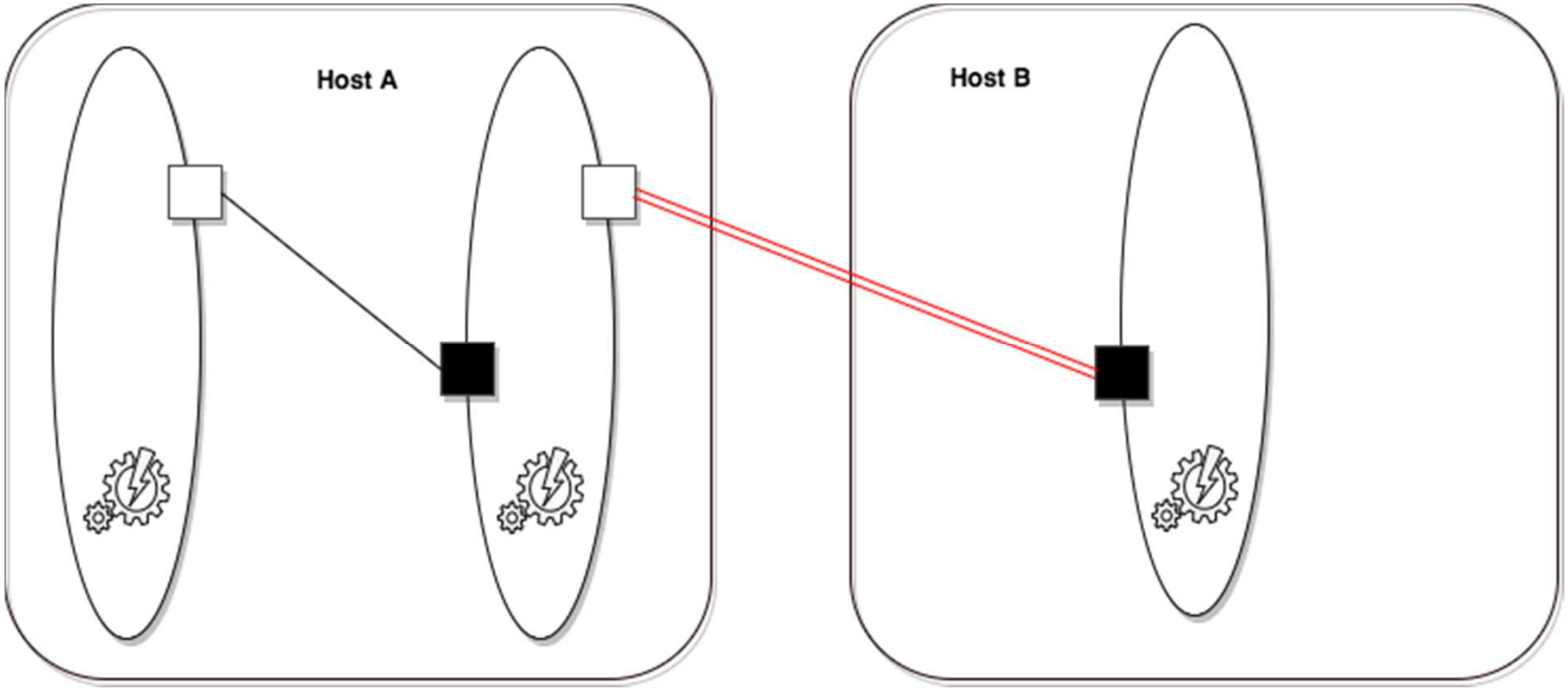
Demo



Papyrus-RT + Node-RED



Distribution



Deployment optimization

- IoT environments are heterogeneous, dynamic, and volatile
- Deployment greatly impact the Quality-of-Service (QoS)
- Deployment optimization: generation of deployment plans that optimize certain QoS goals
- Self-adaptive deployment: dynamically re-deploy components in response to sudden changes in the environment

Thank You!