



# cloud.iO Introduction & Thesis presentation

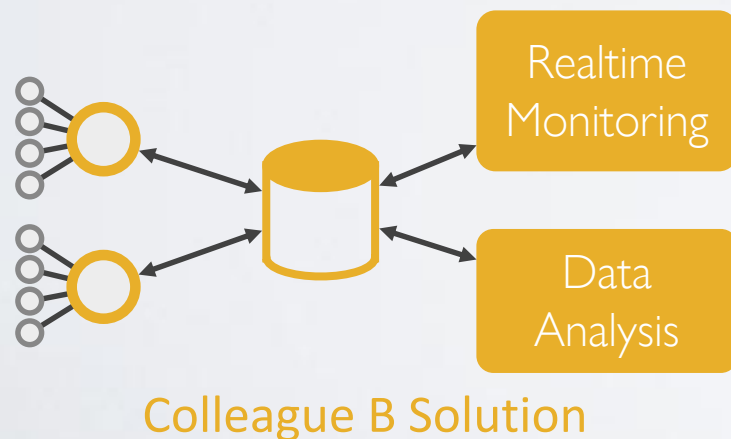
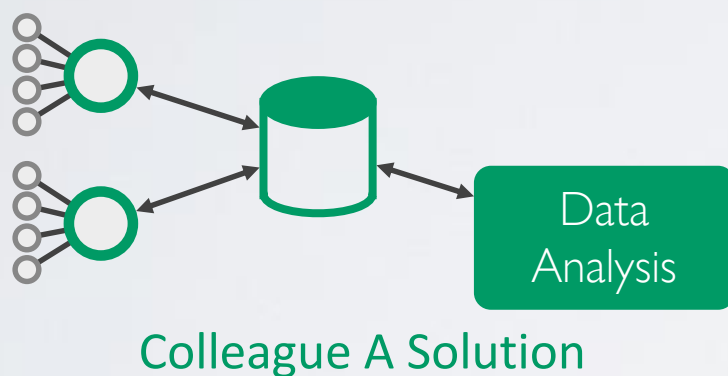
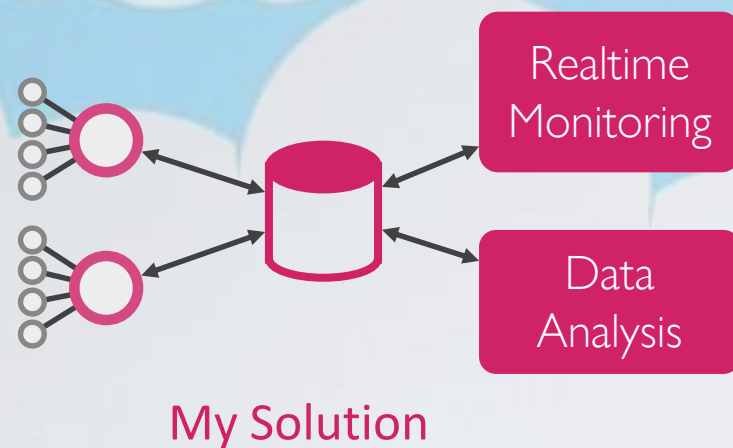
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Why **cloud.iO**?

# Motivation for cloud.iO



- **Our problems:**

- Each time a new solution for similar problems is developed.
- There is not that much budget to create a stable/flexible solution.
- Data analyst has to work each time with different systems.
- Data of different projects are not simple to compare and may have to be converted first.
- Scientists can not easily share their data with others.
- Control often is not possible, as the data passes by a database.
- Monitoring is mostly very inefficient (Database Polling for example)





# cloud.iO Concepts

# Actors



Endpoint

- **Endpoint**

- Publishes its complete data model.
- Sends messages when some data of the model changes.
- Some data can be modified from the outside (control, parameters).

- **User/Application**

- Has access right on one or more „Endpoints“.
- Can give access to Endpoint to other users/applications.
- Has access to a subset of all „Endpoints“ data models.
- Can search for actual data using schemes (interfaces, data-classes).
- Can get actual and historical data for „Endpoints“.
- Can control set points and parameters of „Endpoints“.



User

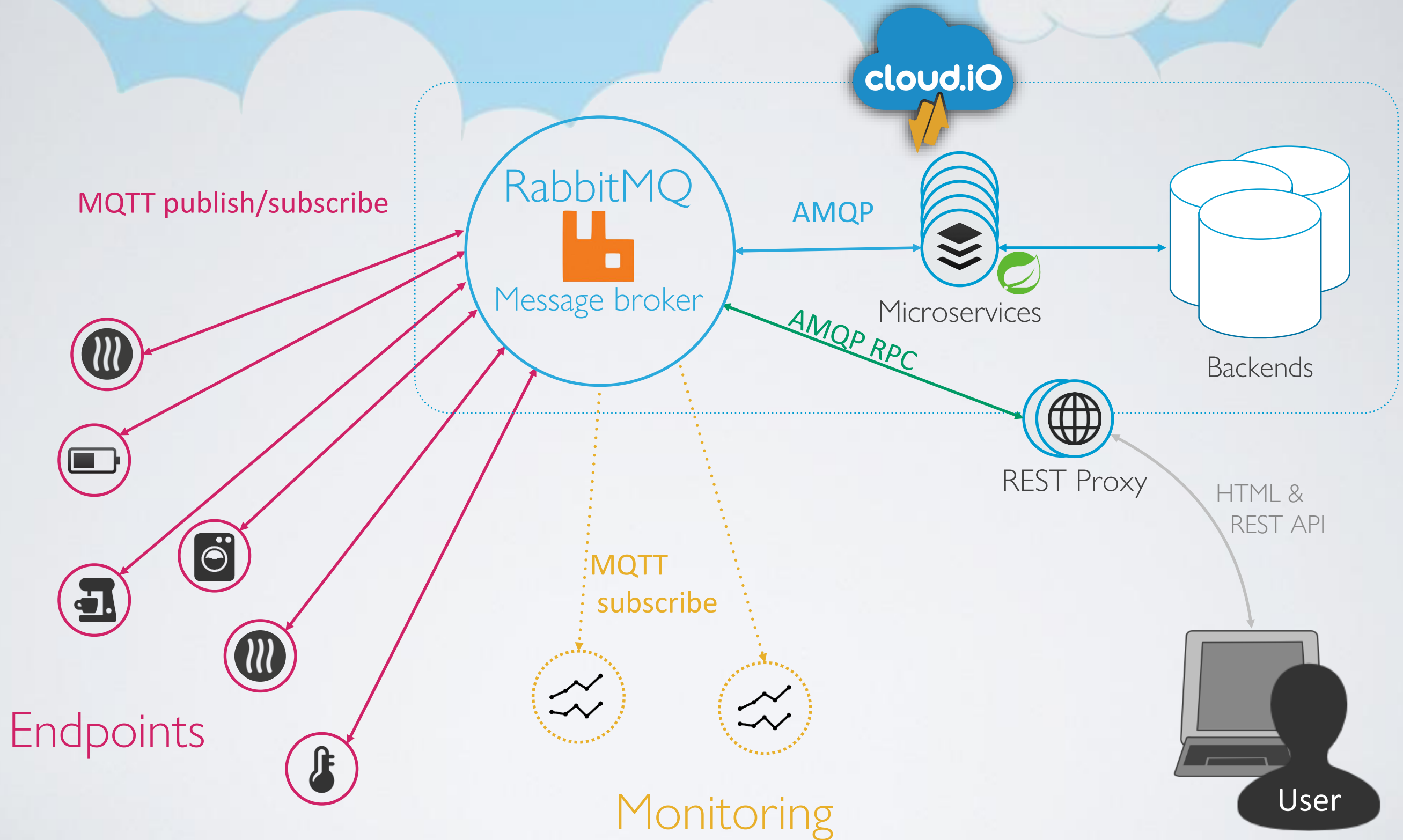


Application



# cloud.iO Architecture

# Overview





# Backends



Authentication / Permission

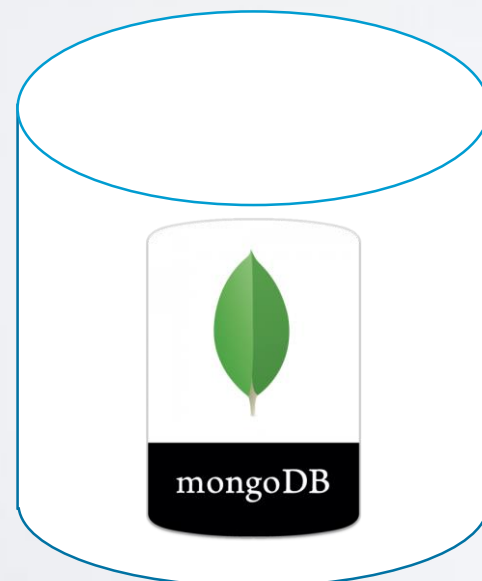
Endpoint Repository

Logs Repository

History Repository

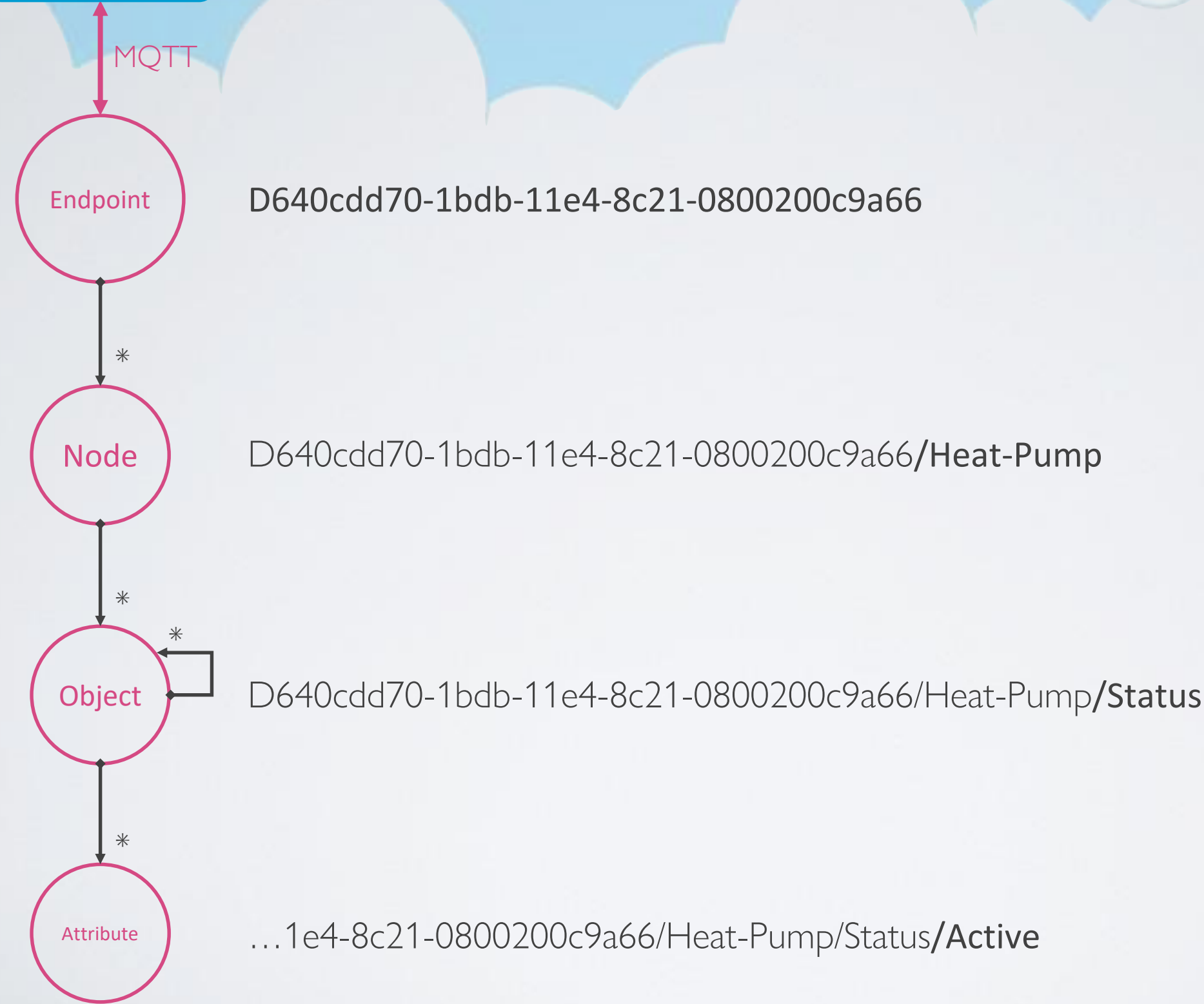
MongoDB  
Backend

InfluxDB  
Backend





# Endpoint structure



# Topic / json Object model



Endpoint: D640cdd70-1bdb-11e4-8c21-0800200c9a

```
{
  „uuid“: „640cdd70-1bdb-11e4-8c21-0800200c9a66“,
  „nodes“: {
    „Meteo“: {
      „implements“: [„MeteoStation“],
      „objects“: {
        „temperatures“: {
          „conforms“: null,
          „objects“: {
            „inside“: {
              „conforms“: „TemperatureMeasure“,
              „attributes“: {
                „unit“: {
                  „constraint“: „Static“,
                  „timestamp“: null,
                  „value“: „K“
                },
                „temperature“: {
                  „type“: „Number“,
                  „constraint“: „Measure“,
                  „timestamp“: 45878945.457,
                  „value“: 19.2
                }
              }
            }
          }
        }
      }
    }
  }
}
```

Topic:

@UPDATE/D640cdd70-1bdb-11e4-8c21-0800200c9a/Meteo/temperatures/inside/temperature

```
{
  „TYPE“: „Number“,
  „constraint“: „Measure“,
  „timestamp“: 45878945.457,
  „value“: 19.2
}
```



Master thesis: enhance **cloud.iO**

# Clouds analysis



Siot  
B+B SmartWorx  
Particle Cloud  
Azure IOT  
Google Cloud IOT Core  
AWS IOT  
Alibaba Cloud  
mainflux labs  
thingsboard  
kaa platform

- **What is missing in cloud.iO**

- A complete REST API
- Remote execution of jobs on Endpoint

- **What is missing in IoT Clouds**

- Standardization

- **What are cloud.iO plus**

- Unique access control architecture
- Standardization
- Open Source

# Normalization with W3C WoT



## cloud.iO Version of Node

```
{
  "demoNode": {
    "implements": [],
    "objects": {
      "demoObject": {
        "objects": {
        },
        "attributes": {
          "demoMeasure": {
            "constraint": "Measure",
            "type": "Number",
            "timestamp": 1569488908.013,
            "value": -0.850433133901474
          },
          "demoSetpoint": {
            "constraint": "SetPoint",
            "type": "String",
            "timestamp": -1.0
          }
        }
      }
    }
  }
}
```

## WoT (reduced) Version of Node

```
{
  "properties": {
    "demoSetpoint": {
      "type": "Integer",
      "forms": [{
        "href": "https://localhost:8081/api/v1/getAttribute",
        "op": "readproperty"
      },
      {
        "href": "https://localhost:8883/@set/bc0f1bf8-bdae-11e9-9cb5-2a2ae2dbcce4/demoObject/demoSetpoint",
        "op": "writeproperty"
      },
      {
        "href": "https://localhost:8081/api/v1/setAttribute",
        "op": "writeproperty"
      }
    ]
  },
  "events": {
    "updateDemoObjectDemoSetpoint": {
      "data": {
        "type": "Integer"
      },
      "forms": [{
        "href": "https://localhost:8081/api/v1/notifyAttributeChange",
        "op": "longpoll",
        "subprotocol": "observeProperty"
      },
      {
        "href": "https://localhost:8883/@set/bc0f1bf8-bdae-11e9-9cb5-2a2ae2dbcce4/demoObjectdemoSetpoint",
        "op": "subscribeEvent"
      }
    ]
  }
}
```

# Open source



<http://cloudio.hevs.ch>

<https://github.com/cloudio-project>



cloudio-rabbitmq-docker



cloudio-services



cloudio-documents



cloudio-documentation



cloudio-endpoint-java



cloudio-endpoint-python



cloudio-grafana-plugin



cloudio-project.github.io