

## Test Dokumentation

### Aufgabe 2

- ✓ HTTP-Server ist erreichbar  
localhost:8080/sensor/all -> Time: 5ms, Status: 200 OK
- ✓ Sensore liefern Informationen via UDP an die Zentrale **fehlerfrei** zurück  
Informationen die die Zentrale erhält:  
SensorType: Consumer, Power: 12217 Kw, SensorName: Consumer  
SensorType: Generator, Power: 2979 Kw, SensorName: Solarpower  
SensorType: Generator, Power: 171545 Kw, SensorName: Windpower  
SensorType: Generator, Power: 161744 Kw, SensorName: Nuclearpower
- ✓ Informationen der Sensoren sind JSON-Format über den Webbrowser einsehbar

```
{
  "SensorType": "Consumer",
  "Power": "12217 Kw",
  "SensorName": "Consumer"
}
{
  "SensorType": "Generator",
  "Power": "2979 Kw",
  "SensorName": "Solarpower"
}
{
  "SensorType": "Generator",
  "Power": "171545 Kw",
  "SensorName": "Windpower"
}
{
  "SensorType": "Generator",
  "Power": "161744 Kw",
  "SensorName": "Nuclearpower"
}
```
- ✓ Container werden erzeugt  
Alle Container werden im Terminal erfolgreich erzeugt und mit *done* abgeschlossen

### Aufgabe 3

RPC Funktionen werden getestet:

- ✓ Printing-Funktion Aufruf: Externer Client

```
private static void perform(Printing.DataSender.Client client) throws TException {
    String print = client.printing( dataa: "Hello from the other side \n");
    System.out.println(print);
}
```

- ✓ Printing-Funktion Aufruf: Handler

```
@Override
public String printing(String dataa) throws Exception {
    return dataa
        + "+++++++ Latest Sensor Data ++++++++" + "\n"
        + dat + "\n ";
}
```

- ✓ Thrift Server startet Service

```
HTTP Thread started
Started the UDP socket server at port 6543 with buffer size 256
Starting the Thrift Service on port 9090...
```

- ✓ Datenübermittlung über RPC erfolgreich

```
Hello from the other side
+++++++ Latest Sensor Data ++++++++
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Windpower",
    "Port": 60244,
    "Power": "0 Kw"
}
+++++++ History ++++++++
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Nuclearpower",
    "Port": 51637,
    "Power": "154269 Kw"
}
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Nuclearpower",
    "Port": 51638,
    "Power": "158022 Kw"
}
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Solarpower",
    "Port": 60916,
    "Power": "1515 Kw"
}
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Solarpower",
    "Port": 60917,
    "Power": "1315 Kw"
}
{
    "SensorType": "Generator",
    "Address": "/127.0.0.1",
    "SensorName": "Nuclearpower",
    "Port": 60918,
    "Power": "199821 Kw"
}
```

- ✓ Komponenten können durch RPC abgeschaltet und eingeschaltet werden

```
Turn on the Company
false
Received a packet: IP:Port: /127.0.0.1:59468, length: 67, Sensor Type: Consumer, Sensor Name: Company, Sensor Power: 11194 Kw
Turn off the Nuclear
false
Received a packet: IP:Port: /127.0.0.1:57553, length: 74, Sensor Type: Generator, Sensor Name: Nuclearpower, Sensor Power: 152675 Kw
```

## Aufgabe 4

- ✓ Sensoren übermitteln Daten über MQTT

```
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Nuclearpower","Power":"143024 Kw"}
atomkraft    | Message sent with payload: {"SensorType":"Generator","SensorName":"Nuclearpower","Power":"143024 Kw"}
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Windpower","Power":"0 Kw"}
windkraft    | Message sent with payload: {"SensorType":"Generator","SensorName":"Windpower","Power":"0 Kw"}
solarkraft   | Message sent with payload: {"SensorType":"Generator","SensorName":"Solarpower","Power":"2977 Kw"}
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Solarpower","Power":"2977 Kw"}
consumer     | Message sent with payload: {"SensorType":"Consumer","SensorName":"Consumer","Power":"11203 Kw"}
central      | NEW MQTT:{"SensorType":"Consumer","SensorName":"Consumer","Power":"11203 Kw"}
atomkraft    | Message sent with payload: {"SensorType":"Generator","SensorName":"Nuclearpower","Power":"171022 Kw"}
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Nuclearpower","Power":"171022 Kw"}
windkraft    | Message sent with payload: {"SensorType":"Generator","SensorName":"Windpower","Power":"0 Kw"}
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Windpower","Power":"0 Kw"}
central      | NEW MQTT:{"SensorType":"Generator","SensorName":"Solarpower","Power":"2027 Kw"}
solarkraft   | Message sent with payload: {"SensorType":"Generator","SensorName":"Solarpower","Power":"2027 Kw"}
central      | NEW MQTT:{"SensorType":"Consumer","SensorName":"Consumer","Power":"13154 Kw"}
consumer     | Message sent with payload: {"SensorType":"Consumer","SensorName":"Consumer","Power":"13154 Kw"}
```

- ✓ Daten sind über Webbrowser einsehbar

← → ↻   localhost:8080/sensors/all

```
{
  "SensorType": "Consumer",
  "Power": "12550 Kw",
  "SensorName": "Consumer"
}
{
  "SensorType": "Generator",
  "Power": "1639 Kw",
  "SensorName": "Solarpower"
}
{
  "SensorType": "Generator",
  "Power": "0 Kw",
  "SensorName": "Windpower"
}
{
  "SensorType": "Generator",
  "Power": "196204 Kw",
  "SensorName": "Nuclearpower"
}
```

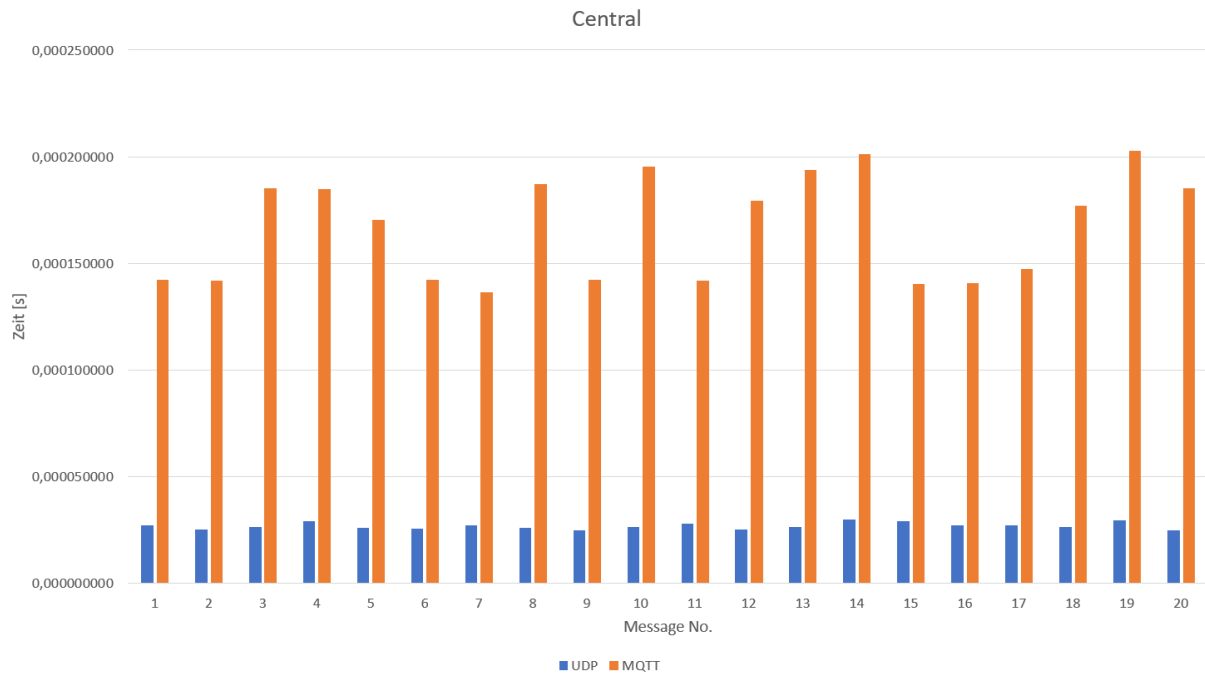
## Performance-Vergleich UDP vs MQTT

UDP:

| Time (Client) | Time (Central) | Time (Diff.) |
|---------------|----------------|--------------|
| 0,000000000   | 0,000026956    | 0,000026956  |
| 10,005107715  | 10,005133014   | 0,000025299  |
| 20,01028789   | 20,01031433    | 0,000026446  |
| 30,01527971   | 30,01530873    | 0,000029023  |
| 40,02051341   | 40,02053935    | 0,000025933  |
| 50,0257522    | 50,02577787    | 0,000025665  |
| 60,03103805   | 60,03106536    | 0,000027306  |
| 70,03626415   | 70,0362901     | 0,000025946  |
| 80,04142468   | 80,04144934    | 0,000024655  |
| 90,04678879   | 90,04681499    | 0,000026205  |
| 100,0522503   | 100,0522784    | 0,000028062  |
| 110,0574969   | 110,057522     | 0,000025122  |
| 120,0670547   | 120,0670812    | 0,000026465  |
| 130,072598    | 130,0726278    | 0,000029803  |
| 140,0776285   | 140,0776575    | 0,000028993  |
| 150,0828799   | 150,082907     | 0,000027067  |
| 160,0883277   | 160,0883547    | 0,000026994  |
| 170,0936232   | 170,0936495    | 0,000026296  |
| 180,0989174   | 180,098947     | 0,000029624  |
| 190,1040528   | 190,1040778    | 0,000024968  |

MQTT:

| Time (Client) | Time (Central) | Time (Diff.) |
|---------------|----------------|--------------|
| 0,000000000   | 0,000142105    | 0,000142105  |
| 10,006739918  | 10,006881852   | 0,000141934  |
| 20,009574666  | 20,009759927   | 0,000185261  |
| 30,012585434  | 30,012770270   | 0,000184836  |
| 40,015432070  | 40,015602295   | 0,000170225  |
| 50,018101018  | 50,018243290   | 0,000142272  |
| 60,020930207  | 60,021066514   | 0,000136307  |
| 70,023760844  | 70,023947804   | 0,000186960  |
| 80,026669389  | 80,026811803   | 0,000142414  |
| 90,029510446  | 90,029705776   | 0,000195330  |
| 100,036587526 | 100,036729228  | 0,000141702  |
| 110,039370704 | 110,039549972  | 0,000179268  |
| 120,042076179 | 120,042269942  | 0,000193763  |
| 130,044917636 | 130,045118741  | 0,000201105  |
| 140,047841503 | 140,047981692  | 0,000140189  |
| 150,050622300 | 150,050763129  | 0,000140829  |
| 160,053602145 | 160,053749345  | 0,000147200  |
| 170,056506290 | 170,056683150  | 0,000176860  |
| 180,059342121 | 180,059544902  | 0,000202781  |
| 190,062197448 | 190,062382818  | 0,000185370  |



Fazit: Übertragung via UDP ist etwas schneller als MQTT.

### Aufgabe 5

✓ Zentralen kommunizieren untereinander

```
thirdCentral | Data From Second Central
thirdCentral | ++++++
thirdCentral | Total History Number :8
thirdCentral |
thirdCentral | Total Page :1
thirdCentral | ++++++ History ++++++
thirdCentral | Current Page: 1
thirdCentral | [{
thirdCentral |   "SensorType": "Generator",
thirdCentral |   "SensorName": "CoalPower",
thirdCentral |   "Power": "184289 Kw"
thirdCentral | },
thirdCentral | {
thirdCentral |   "SensorType": "Generator",
thirdCentral |   "SensorName": "CoalPower",
thirdCentral |   "Power": "142415 Kw"
thirdCentral | },
thirdCentral | {
thirdCentral |   "SensorType": "Generator",
thirdCentral |   "SensorName": "CoalPower",
thirdCentral |   "Power": "160833 Kw"
thirdCentral | },
thirdCentral | {
thirdCentral |   "SensorType": "Generator",
thirdCentral |   "SensorName": "CoalPower",
thirdCentral |   "Power": "155943 Kw"
thirdCentral | },
thirdCentral | {
thirdCentral |   "SensorType": "Generator",
thirdCentral |   "SensorName": "CoalPower",
thirdCentral |   "Power": "160158 Kw"
thirdCentral | }
thirdCentral | ]
```

```
secondCentral Data From Third Central
secondCentral ++++++
secondCentral Total History Number :10
secondCentral
secondCentral Total Page :2
secondCentral ++++++ History ++++++
secondCentral Current Page: 1
secondCentral [{
secondCentral   "SensorType": "Consumer",
secondCentral   "SensorName": "HouseHold",
secondCentral   "Power": "14456 Kw"
secondCentral ,
secondCentral {
secondCentral   "SensorType": "Consumer",
secondCentral   "SensorName": "HouseHold",
secondCentral   "Power": "14214 Kw"
secondCentral ,
secondCentral {
secondCentral   "SensorType": "Consumer",
secondCentral   "SensorName": "HouseHold",
secondCentral   "Power": "13338 Kw"
secondCentral ,
secondCentral {
secondCentral   "SensorType": "Consumer",
secondCentral   "SensorName": "HouseHold",
secondCentral   "Power": "11152 Kw"
secondCentral ,
secondCentral {
secondCentral   "SensorType": "Consumer",
secondCentral   "SensorName": "HouseHold",
secondCentral   "Power": "13570 Kw"
secondCentral }
secondCentral ]
central Data From Third Central
central ++++++
central Total History Number :10
central
central Total Page :2
central ++++++ History ++++++
central Current Page: 1
central [{
central   "SensorType": "Consumer",
central   "SensorName": "HouseHold",
central   "Power": "14456 Kw"
central ,
central {
central   "SensorType": "Consumer",
central   "SensorName": "HouseHold",
central   "Power": "14214 Kw"
central ,
central {
central   "SensorType": "Consumer",
central   "SensorName": "HouseHold",
central   "Power": "13338 Kw"
central ,
central {
central   "SensorType": "Consumer",
central   "SensorName": "HouseHold",
central   "Power": "11152 Kw"
central ,
central {
central   "SensorType": "Consumer",
central   "SensorName": "HouseHold",
central   "Power": "13570 Kw"
central }
central ]
central
```

- ✓ Zentrale fällt aus und startet später dann neu

```
central | Central Is Offline
central | Central Is Offline
```

nach einer Minute startet die Zentrale neu:

```
central | NEW MQTT:{"SensorType":"Generator","SensorName":"Windpower","Power":"181648 Kw"}
central | NEW MQTT:{"SensorType":"Generator","SensorName":"Solarpower","Power":"4573 Kw"}
```

- ✓ Während des Ausfalls einer Zentrale werden die zuletzt erhaltenen Daten übermittelt

*Letztes Update der Zentrale:*

```
Data From Central
+++++
Total History Number :102

Total Page :20
+++++ History +++++
Current Page: 1
[
  {
    "SensorType": "Generator",
    "SensorName": "Nuclearpower",
    "Power": "196996 Kw"
  },
  {
    "SensorType": "Generator",
    "SensorName": "Windpower",
    "Power": "141868 Kw"
  },
  {
    "SensorType": "Generator",
    "SensorName": "Nuclearpower",
    "Power": "170284 Kw"
  },
  {
    "SensorType": "Consumer",
    "SensorName": "Consumer",
    "Power": "13607 Kw"
  },
  {
    "SensorType": "Generator",
    "SensorName": "Solarpower",
    "Power": "2331 Kw"
  }
]
```

*Was die anderen Zentralen erhalten solange die eine Zentrale ausgefallen ist:*

```
thirdCentral | Data From Central
thirdCentral | +++++
thirdCentral | Total History Number :114
thirdCentral | Total Page :22
thirdCentral | +++++ History +++++
thirdCentral | Current Page: 1
thirdCentral | [
thirdCentral |   {
thirdCentral |     "SensorType": "Generator",
thirdCentral |     "SensorName": "Nuclearpower",
thirdCentral |     "Power": "196996 Kw"
thirdCentral |   },
thirdCentral |   {
thirdCentral |     "SensorType": "Generator",
thirdCentral |     "SensorName": "Windpower",
thirdCentral |     "Power": "141868 Kw"
thirdCentral |   },
thirdCentral |   {
thirdCentral |     "SensorType": "Generator",
thirdCentral |     "SensorName": "Nuclearpower",
thirdCentral |     "Power": "170284 Kw"
thirdCentral |   },
thirdCentral |   {
thirdCentral |     "SensorType": "Consumer",
thirdCentral |     "SensorName": "Consumer",
thirdCentral |     "Power": "13607 Kw"
thirdCentral |   },
thirdCentral |   {
thirdCentral |     "SensorType": "Generator",
thirdCentral |     "SensorName": "Solarpower",
thirdCentral |     "Power": "2331 Kw"
thirdCentral |   }
thirdCentral | ]
```