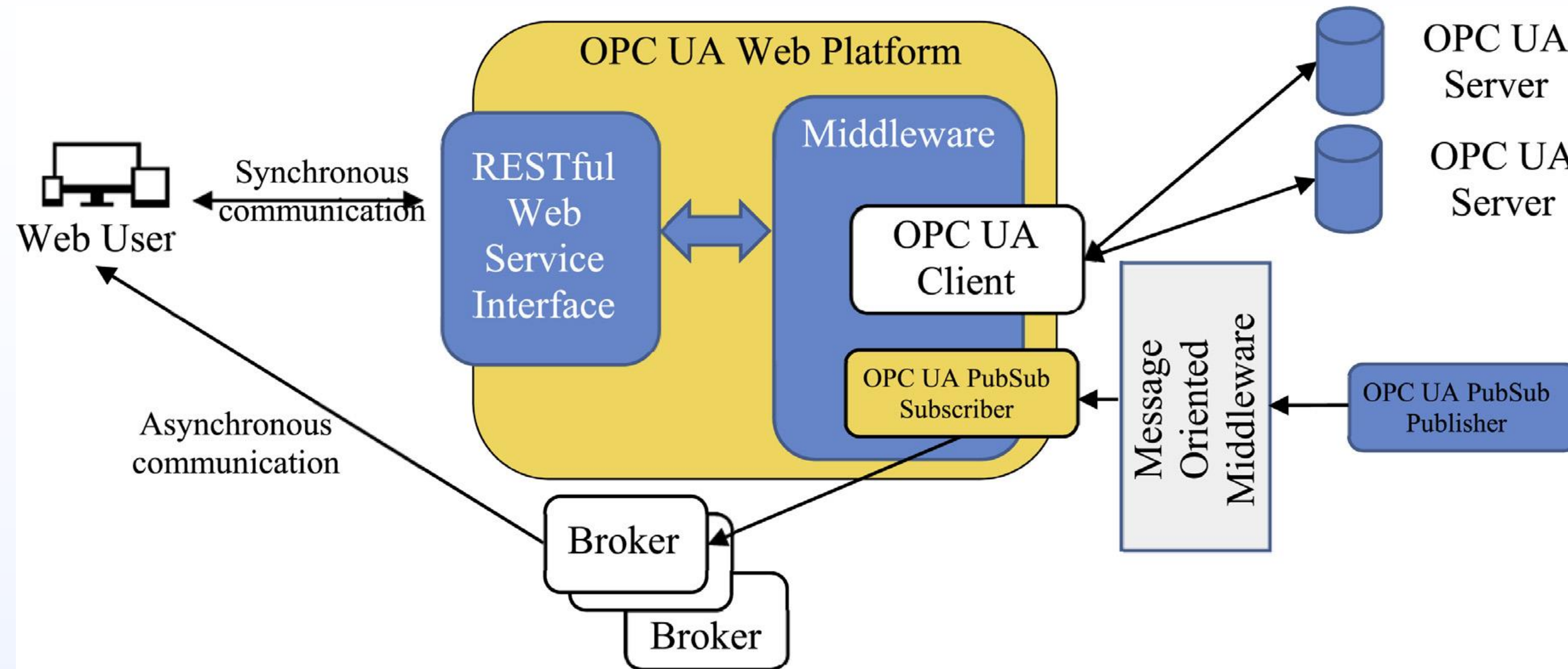


## Enhance interoperability in Industry 4.0 using OPC UA and Web technologies



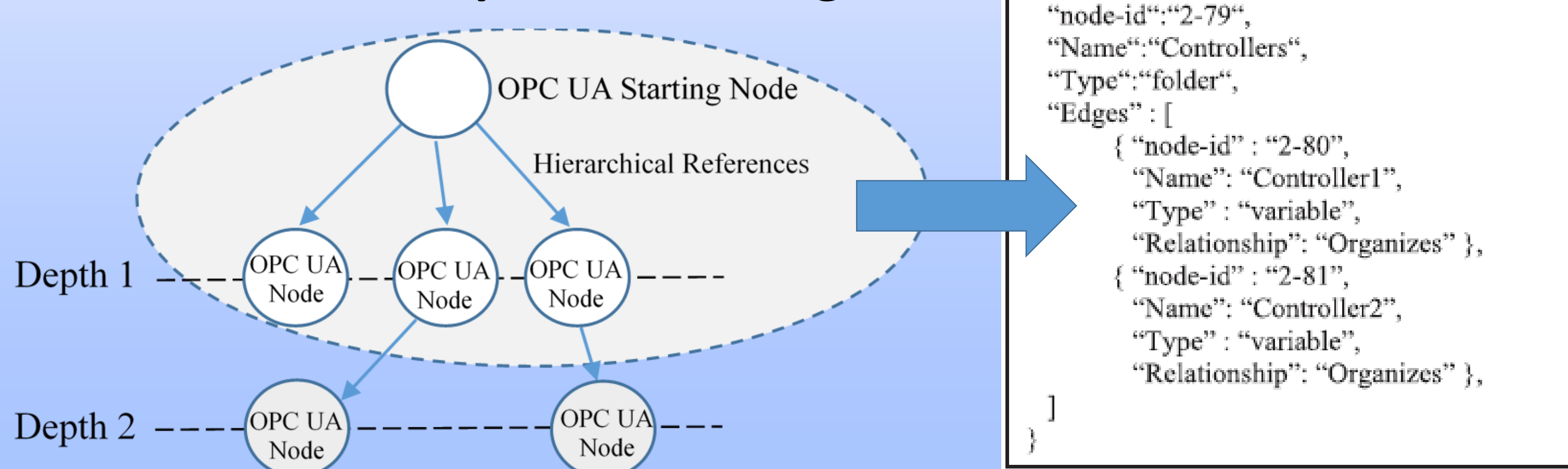
### Features of the Platform

- **Secure Access:** Authentication by means of JWT
- **Stateless communication:** No Session management in the interaction with the Platform
- **Address Space Browsing:** explore multiple OPC UA Address Spaces.
- **Node reading:** read the state of an OPC UA Node
- **Node writing:** write the value of an OPC UA Variable
- **Monitoring:** used to monitor the change in the value of an OPC UA Variable
- **No OPC UA Knowledge required:** constrained device can access OPC UA Information without being OPC UA-compliant

### REST Interface

Resource	GET	POST
/data-sets	Returns the list of available data sets	-
/data-sets/{dataset-id}/nodes/	Returns the entry point of a given data set	-
/data-sets/{dataset-id}/nodes/{node-id}	Returns the state of a given Node	Update the value of a given Node (only for a Variable)
/authenticate	-	Return the authentication token
/data-sets/{dataset-id}/monitor	-	Start monitoring the value of variable nodes
/data-sets/{dataset-id}/stop-monitor	-	Stop monitoring monitored node

### OPC UA Address Space Browsing



### Exposing DataType of Values

```

<opc:StructuredType Name="TController">
  <opc:Field Name="var1" TypeName="opc:Int 32"/>
  <opc:Field Name="var2" TypeName="opc:Type2"/>
</opc:StructuredType>
.....
<opc:StructuredType Name="Type2">
  <opc:Field Name="var3" TypeName="opc:Int 32"/>
  <opc:Field Name="var4" TypeName="opc:String"/>
</opc:StructuredType>

```

```

{
  "$schema": ".../draft-04/schema#",
  "type": "object",
  "properties": {
    "var1": {"type": "integer"},
    "var2": {
      "type": "object",
      "properties": {
        "var3": {"type": "integer"},
        "var4": {"type": "string"}
      },
      "required": ["var3", "var4"]
    },
    "required": ["var1", "var2"],
    "additionalProperties": false
  }
}

```

DataTypes descriptions are converted in JSON Schemas and returned as state of a Variable Node

OpenSource implementation available on GitHub

<https://github.com/OPCUAUniCT/OPCUAWebPlatformUniCT>

Used Technologies:

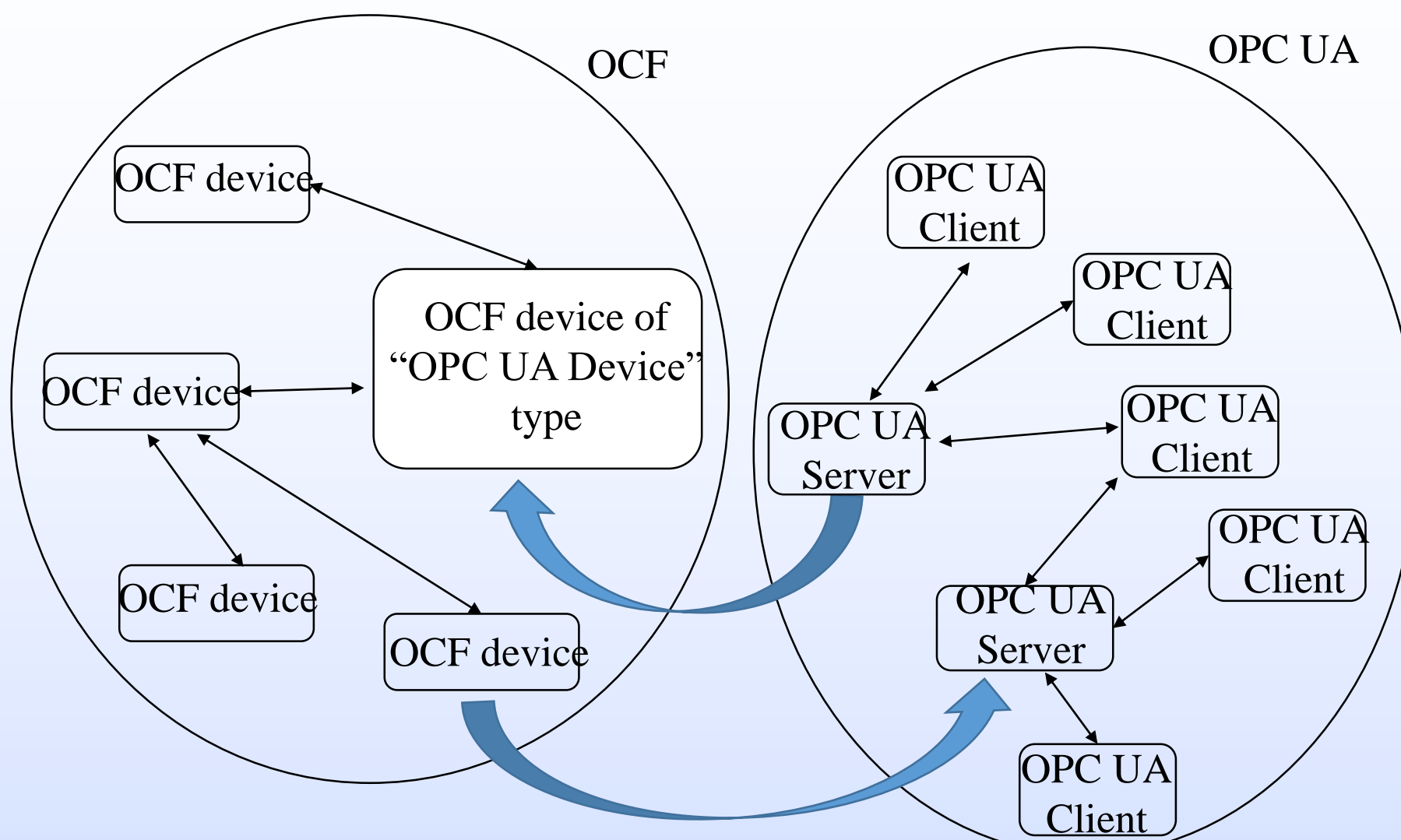
- ASP.NET Core
- MQTT
- SignalR

### Publications

- Cavalieri S, Di Stefano D, Salafia M G, Scroppo M S (2017). *Integration of OPC UA into a Web-based Platform to enhance interoperability*. Proceedings of ISIE 2017, 26<sup>th</sup> IEEE International Symposium on Industrial Electronics, 19-21 June 2017, Edinburgh (Scotland, UK)
- Cavalieri S, Di Stefano D, Salafia M G, Scroppo M S (2017). *A Web-based Platform for OPC UA integration in IIoT environment*. Proceedings of ETFA 2017, 22<sup>nd</sup> IEEE International Conference on Emerging Technologies And Factory Automation September 12-15, 2017, Limassol (Cyprus)
- Cavalieri S, Di Stefano D, Salafia M G, Scroppo M S (2017). *OPC UA integration into the Web*. Proceedings of IECON 2017, 43<sup>rd</sup> Annual Conference of the IEEE Industrial Electronics Society, October 29 - November 1 2017, Beijing (China)
- Cavalieri S, Salafia M G, Scroppo M S (2018). *Integrating OPC UA with Web Technologies to Enhance Interoperability*. "Computer Standards and Interface" Journal

## Mapping OPC UA Information Model to OCF

### OPC-OCF Mapping



### OPC UA Resource Type and DeviceType definition

One device Type:

- **x.opc.device** mapping a subset of the OPC UA Server Address Space

Only 3 Resource Type defined:

- **x.opc.object** mapping OPC UA Object
- **x.opc.datavariabile** mapping OPC UA DataVariable
- **x.opc.method** mapping OPC UA Method

### Publications

- Cavalieri S, Marco G S, Scroppo M S (2018). *Mapping OPC UA AddressSpace to OCF resource model*. ICPS 2018, 2018 IEEE Industrial Cyber-Physical Systems, May 15-18, Saint-Petersburg (Russia).
- Cavalieri S, Marco G S, Scroppo M S (2019). *Realising Interoperability between OPC UA and OCF*. Submitted and under review at "IEEE Access" Journal

### DataType mapping

All the values of both OPC UA Properties and DataVariables are mapped using self-describing properties of the Resource Type here defined.

In this way, only 3 Resource Type are necessary for the «OPC UA to OCF» mapping, avoiding to define specific Resource Types for each OPC UA Address space to be mapped.

