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XXXIII cycle

DEFINITION OF NOVEL IOT-BASED SOLUTIONS FOR INTEROPERABILITY IN INDUSTRY 4.0

Tutor: Prof. Ing. Salvatore Cavalieri

Ph.D Brainstorming Day – 29 October 2019, University of Catania

PROJECT AND RESEARCH FIELDS

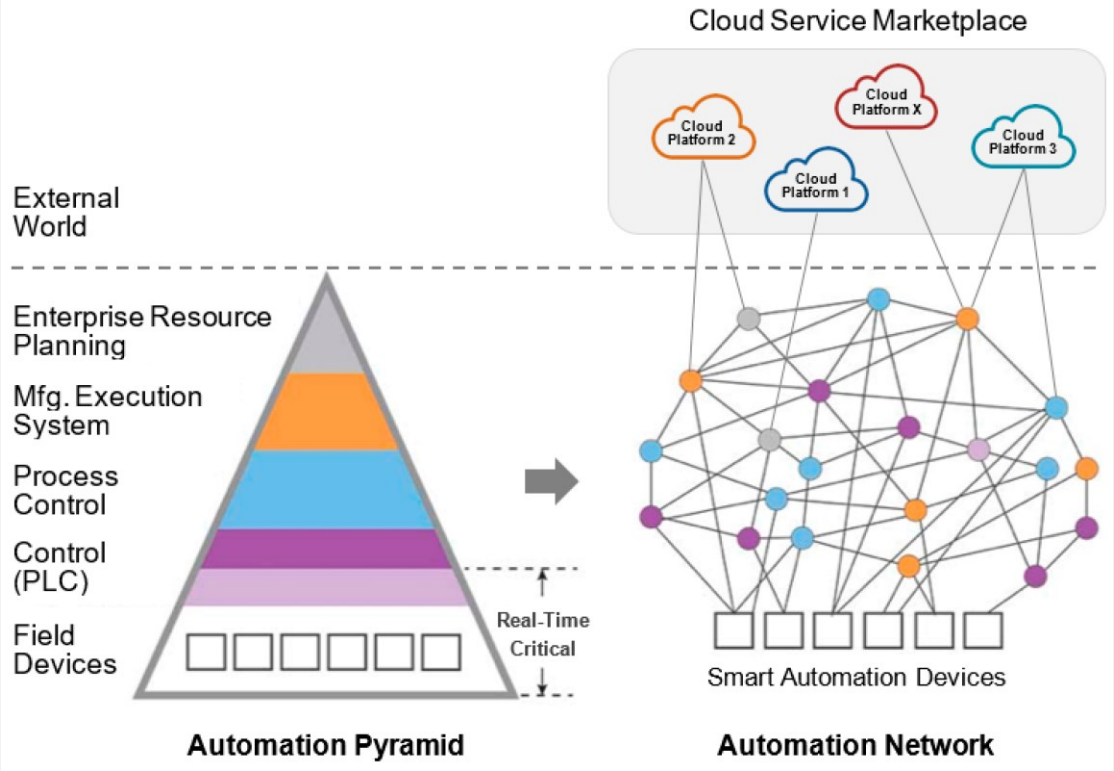
Project: Definition of novel IoT-based solutions for interoperability in Industry 4.0

Research Areas:

- Industry 4.0
- Industrial Internet of Things (IIoT)

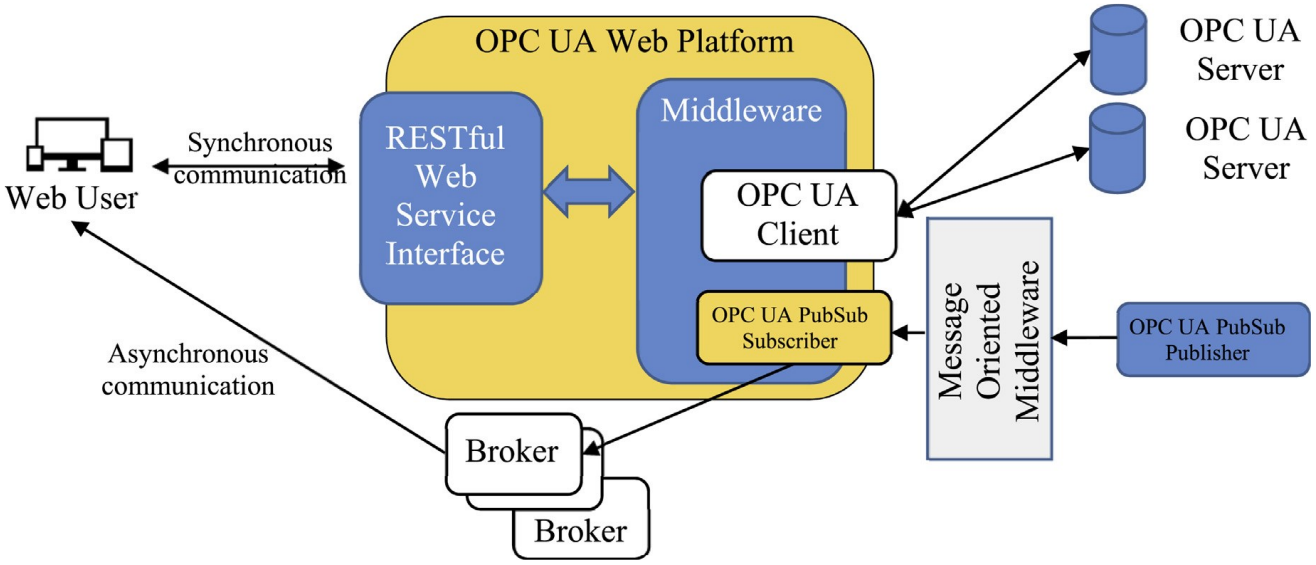
Research Goals:

- Definition of interoperability solutions between applications in Industry 4.0 based on IoT



OPC UA WEB PLATFORM

- This web application allows the interaction with multiple OPC UA Server by means of a RESTful interface, hiding all the details of the Information and Data Model of the OPC UA Protocol.
- Costrained devices can interact with OPC UA Servers without being compliant with OPC UA
- Asynchronous communication using Publisher/Subscriber communication protocol (i.e.,MQTT)

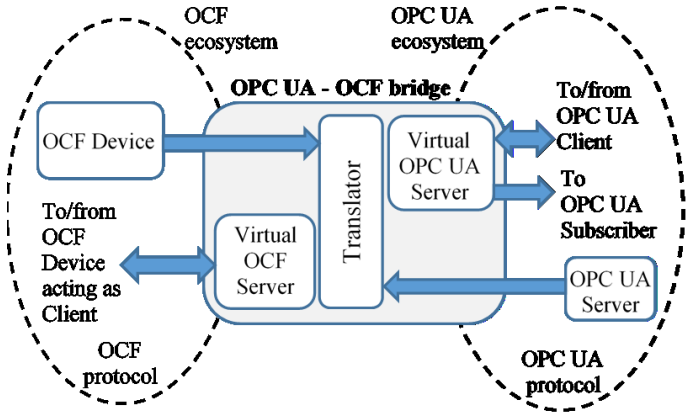


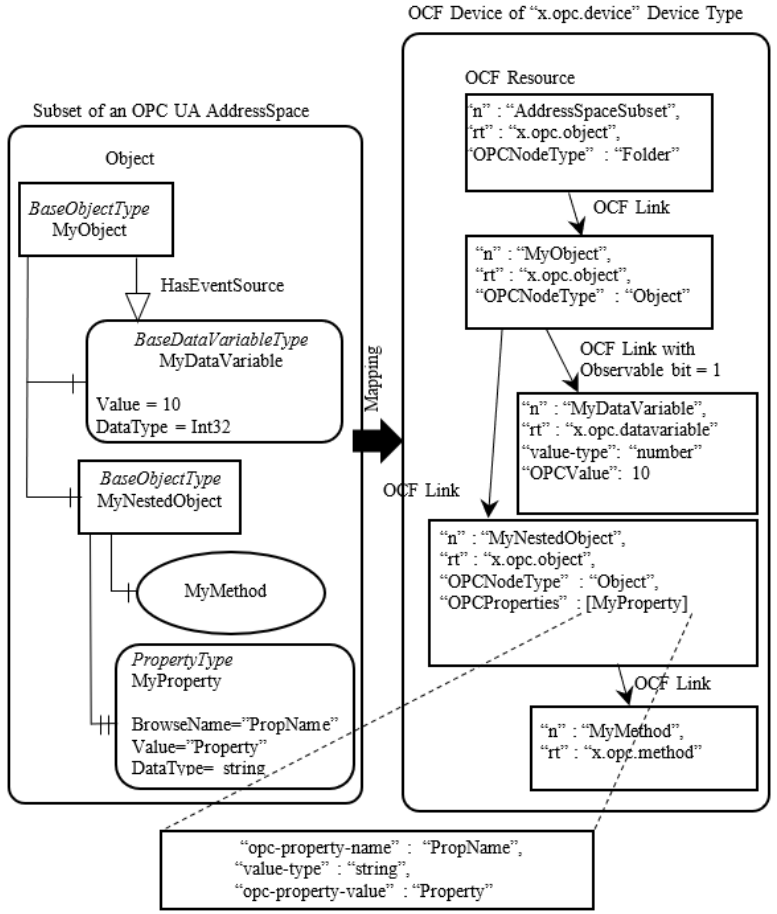
OPC UA WEB PLATFORM PUBLICATIONS

- 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, 26th 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, 22nd 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, 43rd Annual Conference of the IEEE Industrial Electronics Society, October 29 - November 1 2017, Beijing (China)
- Cavalieri S, Salafia M G, Scroppo M S (2017). *Integrating OPC UA with Web Technologies to Enhance Interoperability.*
  - "Computer Standards and Interface" Journal

MAPPING OPC UA INTO OCF RESOURCE MODEL

- Exposing OPC UA Servers in an IoT environmet
  - Definition of new Resource Types modelling OPC UA Information Model elements
- Definition of a new Device Type containing all the Resources mapping a subset of an OPC UA Server Address Space
- Maintaining hierarchies in the mapping
- Mapping for Data Types in JSON base type
  - Definition of self-describing property for values due to the lack of new data type definition in OCF





MAPPING OPC UA INTO OCF PUBLICATIONS

- Cavalieri S, Salafia M G, Scroppo M S (2018). *Realizing interoperability between OPC UA and OCF.*
  - *"IEEE Access" Journal*
- Cavalieri S, Salafia M G, Scroppo M S (2018). *Towards interoperability between OPC UA and OCF.*
  - "Journal of Industrial Information Integration" Journal
- Cavalieri S, Scroppo M S (2018). *Mapping OPC UA AddressSpace to OCF resource model*.
  - Proceedings of ICPS 2018, 1st International Conference on Industrial Cyber-Physical System, 15-18 May 2018, Saint-Petersburg (Russia).

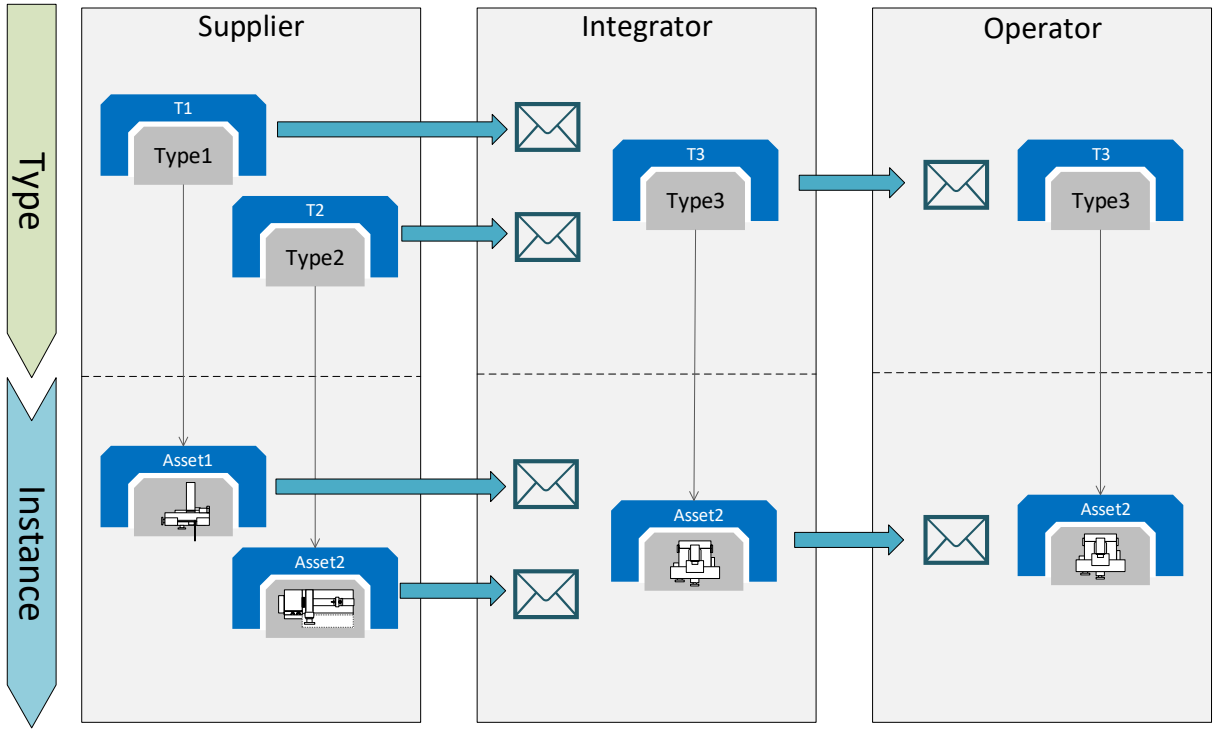
OPC UA-BASED ASSET ADMINISTRATION SHELL

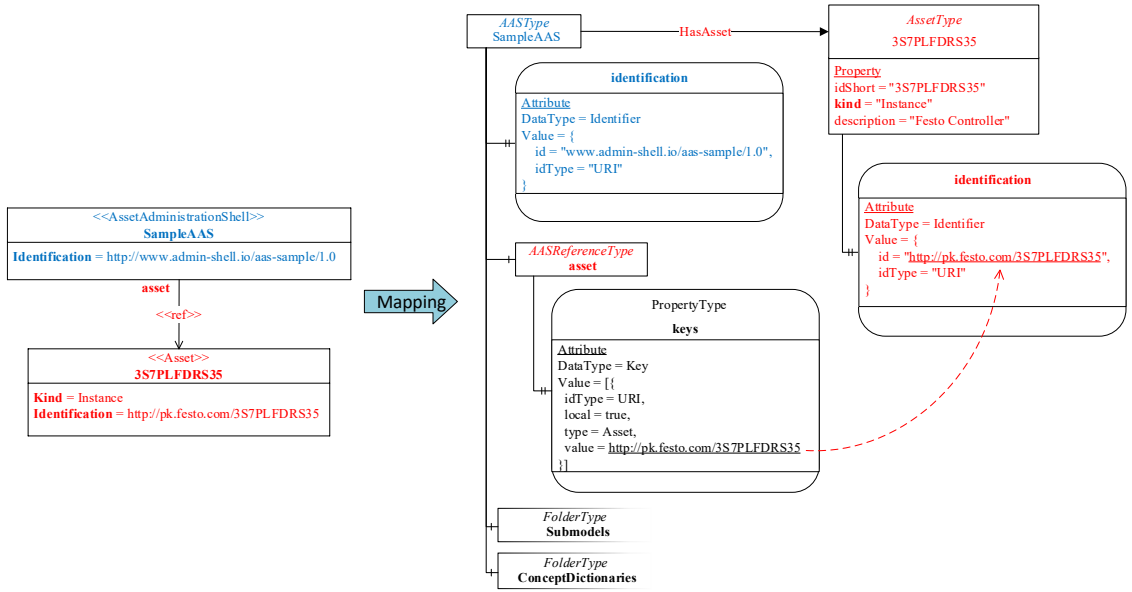
Definizione di una implementazione di AAS utilizzando OPC UA.

- Nuove soluzioni per lo scambio di informazioni tra partner in una value-chain network.
- Tecniche di modellazione necessarie per rappresentare un AAS all'interno di un Server OPC.
- Esporre i dati e la semantica dei dati in maniera consistente.

Questo lavoro ha portato alla definizione di un **Information Model** per OPC UA e alla creazione di **un'estensione dello stack di OPC UA** per Node.js come proof of concept.

Il lavoro è stato svolto presso la **TU Dresden** per un periodo di **8 mesi** a Dresda previsti dal progetto di dottorato.





OPC UA-BASED ASSET ADMINISTRATION SHELL

Come risultato del lavoro svolto è stato realizzato un Command Line Interpreter (CLI) in grado di ricevere come input un AAS serializzata in XML e deployare un server OPC UA esponendo le informazioni di tale AAS senza l'intervento di un umano.

Questo risultato dimostra come OPC UA possa essere utilizzato nel processo di scambio di AAS fra partners esponendo le informazioni per mezzo dei suoi servizi.

XML-Serialized AAS

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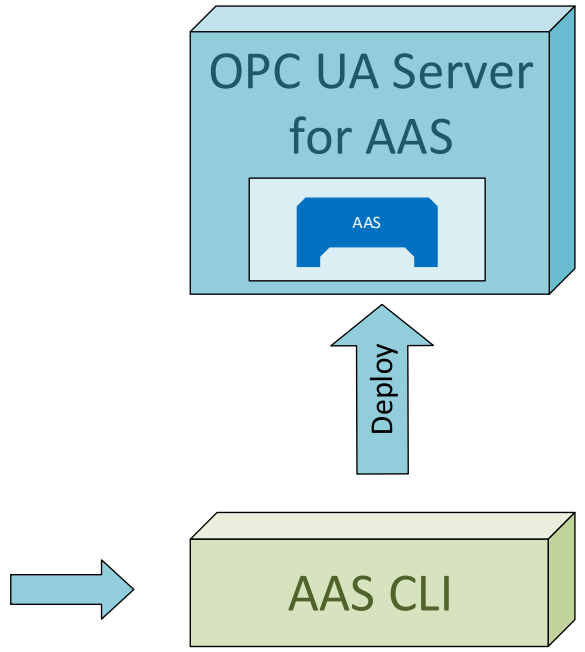

OPC UA-BASED ASSET ADMINISTRATION SHELL

- Cavalieri S, Mulè S, Salafia M G (2019). *OPC UA-based Asset Administration Shell*.
  - Proceedings of IECON 2019, IEEE 45th Annual Conference of the Industrial Electronics Society , 14-17 October 2019, Lisbon (Portugal) *.
- Cavalieri S, Salafia M G (2019). *OPC UA-based Information Model for the Asset Administration Shell in Industry 4.0.*
  - *"IEEE Access" Journal* **

* Presented at the congress

** Submitted and under review

THANKS
FOR YOUR ATTENTION