Alessandra Somma

Digital Twins: open challenges, architectural and security aspects

Tutor: prof. Alessandra De Benedictis

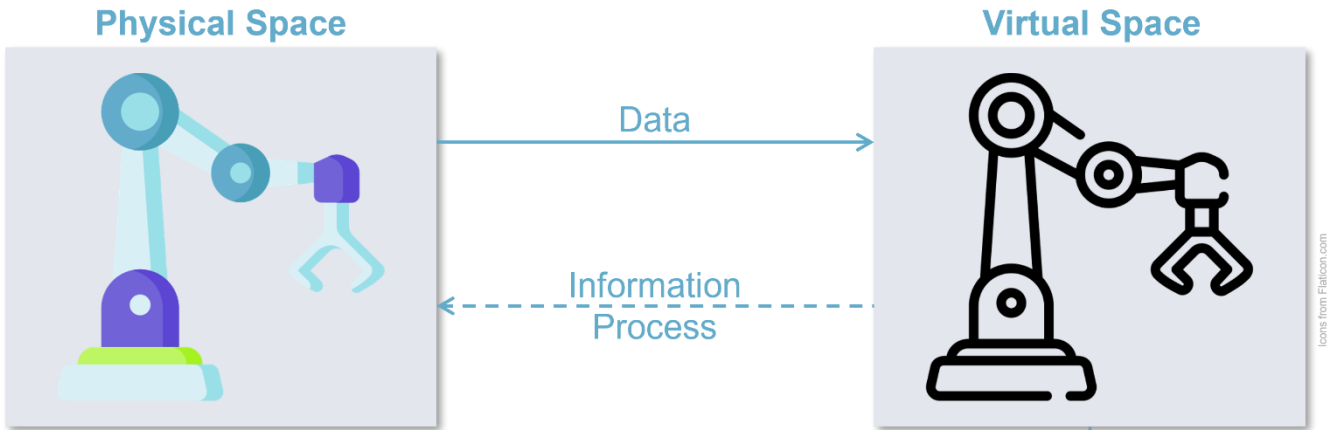
Cycle: XXXVII Year: First

My background

- MSc degree: Computer Engineering
- Research group/laboratory: SECLAB
- PhD start date: November 1st 2021
- Scholarship type: UNINA

Research field of interest

- My research field concerns the **architectural** and **security issues** of **Digital Twin** that is an innovative all-encompassing technology with several benefits (*e.g.*, time, cost e resource reduction of assets production and testing).



Summary of study activities

- **Ad hoc PhD courses / schools**
  - Virtualization technologies and their applications
  - Imprenditorialità accademica
- **Courses borrowed from MSc curricula**
  - Sicurezza dei Dati (UNISA)
  - Risk Assessment
- **Conferences / events attended**
  - *Workshop Nazionale per il Trasferimento Tecnologico e l'Alta Formazione,* June 16-17, 2022, Verona. I presented the poster entitled "Digital Twins: innovative applications, open challenges and architectural aspects".
  - 15th International Conference on the Quality of Information and Communications Technology (QUATIC), September 12-14, 2022, Talavera de la Reina. *Presenting author*

Research activity: Overview (1/3)

- **Problem**

Although the concept of DT has been around for nearly twenty years, industrial and academic interest in this field has ***only recently developed*** and details of successful implementations are ***not publicly available***. This led to *a delay in the widespread implementation and adoption of Digital Twins* that is due to:

  - the lack of a universal DT reference framework;
  - problem and domain-dependence;
  - security concerns;
  - reliance of DT on other fast-evolving technologies.

Research activity: Overview (2/3)

- **Objective**

The goals of my research activity are:

- ***define*** a generalized software architecture that can be used as a reference for the realization of DT-based applications.
- ***identify*** security solutions to cope with security threats to which Digital Twins are inherently exposed and their integration into the architectural proposal.
- define methodology, technologies and tools for ***automatic set-up of Digital Twins***.

Research activity: Overview (3/3)

- **Methodology**

The research activity will be organized in four phases:

I. In-depth **analysis** of state-of-the-art DT requirements, framework proposals, applications and security issues;

II. **Design** of a domain-independent software architecture for DT implementation, also considering state-of-the-art security solutions;

III. Identification of model and language for DT specification and definition of methodology and techniques to *automatically generate DT implementation code*;

IV. **Validation** of the whole proposal in a real-life case study.

Products (if any, otherwise remove)

[P1]	De Benedictis, A., Esposito, C., Somma, A., "Toward the adoption of secure Cyber Digital Twins to enhance Cyber-Physical Systems security", *15th International Conference on the Quality of Information and Communications Technology.* Status: published (https://doi.org/10.1007/978-3-031-14179-9_21).
[P2]	De Benedictis, A., Mazzocca, N., Somma, A., Strigaro, C. (2022). "Digital Twins in Healthcare: an architectural proposal and its application in a social distancing case study", *Journal of Biomedical and Health Informatics* (JBHI). Status: published (https://doi.org/10.1109/JBHI.2022.3205506).
[P3]	De Benedictis, A., Flammini, F., Mazzocca, N., Somma, A., Vitale, F., "A Digital Twin Architecture for Anomaly Detection in the Industrial Internet of Things", *IEEE Transactions on Industrial Informatics* (TII). Status: under 2nd stage of review.

Thank you for your attention!

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