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SOHOMA

LS2N

Heterogeneous Communication Middleware for Digital Twin based Cyber Manufacturing Systems

SoHoMa 2019

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Introduction

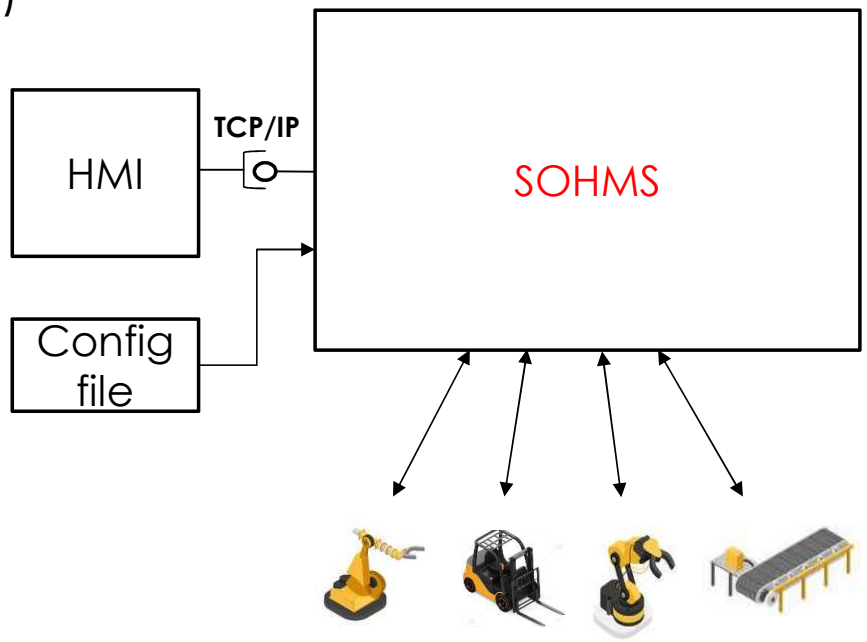
- Holonic Manufacturing System
- SoHMS: Service-oriented Holonic Manufacturing System
  - Importance of software products
- Requirements on SE (specially MDE)
  - Evolution of manufacturing application
- Focusing on the problem of communication failure during evolution

Outline

- Context and Problem statement
  - Improving the manufacturing software construction
- Focus on heterogeneous communication protocols
- Multi Protocol Communication Tool (MPCT) handler
- Back to the overall approach
- Conclusion

Context and Problem statement (1/3)

- Step 0: SoHMS (Gamboa et al., 2015)
- Creation of SoHMS software by Gamboa (Sofal)
- Advantage
  - Distribution automation
  - Communication between holons
- Drawback
  - Hard to reconfigure
  - Hard to evolve
  - Hard to Implement
- Proposition: MDE for software generation

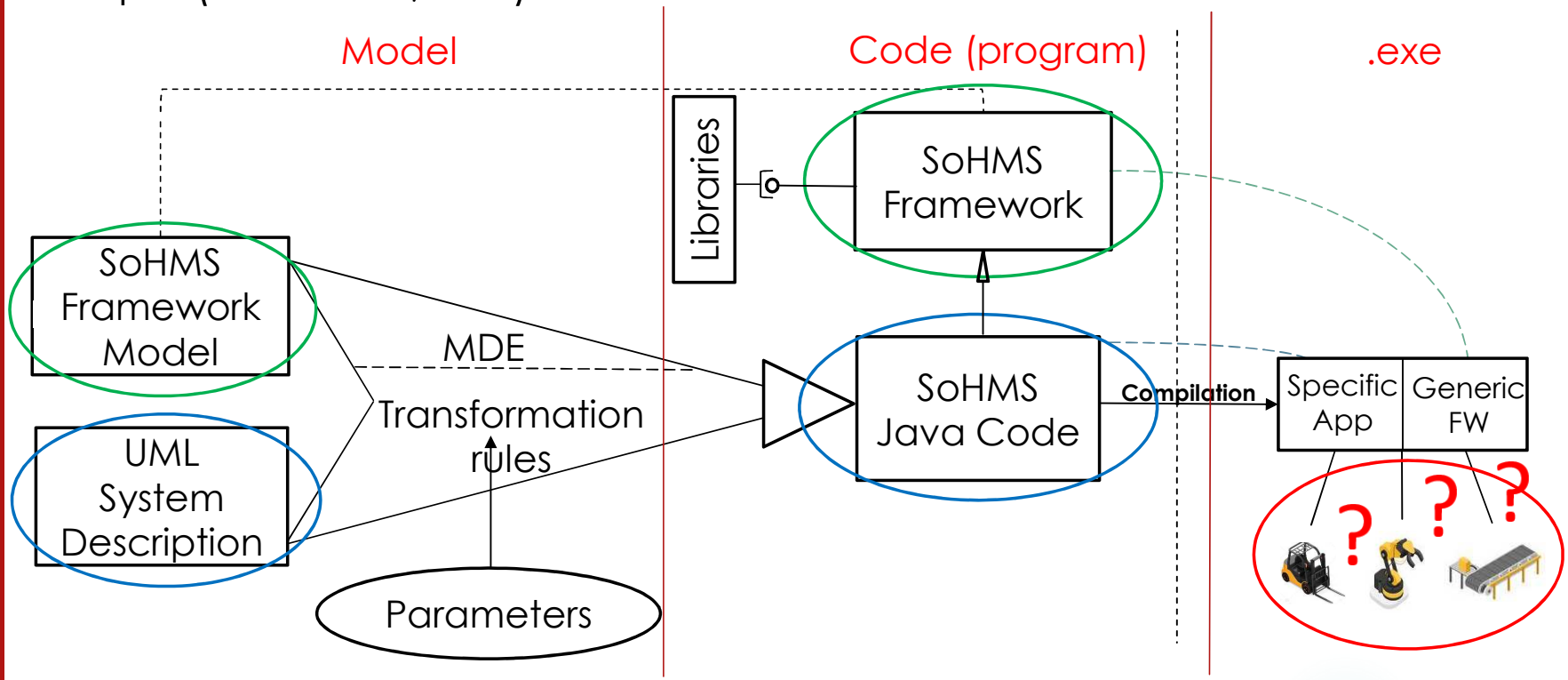


Gamboa's software

Francisco Gamboa Quintanilla. Couplage des Architectures Holonique et Oriente-Services pour la Conception de Systmes de Production Agiles. PhD thesis, Université Nantes-Angers-Le Mans-COMUE, 2015.

Context and Problem statement (2/3)

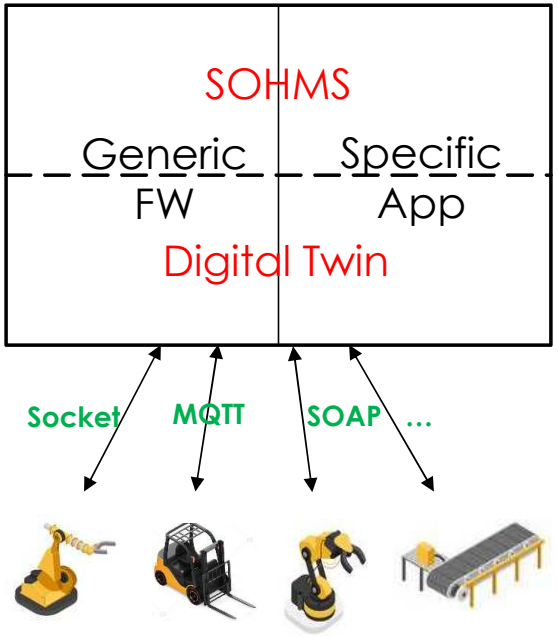
- Step 1: (Tebib et al., 2018)



El Amin Tebib, M., André, P., Cardin, O.: A model driven approach for automated generation of service-oriented holonic manufacturing systems.

Context and Problem statement (3/3)

- Step 2: Ongoing work (contd)
- Digital Twin decoupling the communication between the entities
- Problem: complex communication synchronization
- Need of heterogeneous communication for DT due to:
  - the various nature of the devices
  - legacy applications
  - One communication technology usually cannot suffice



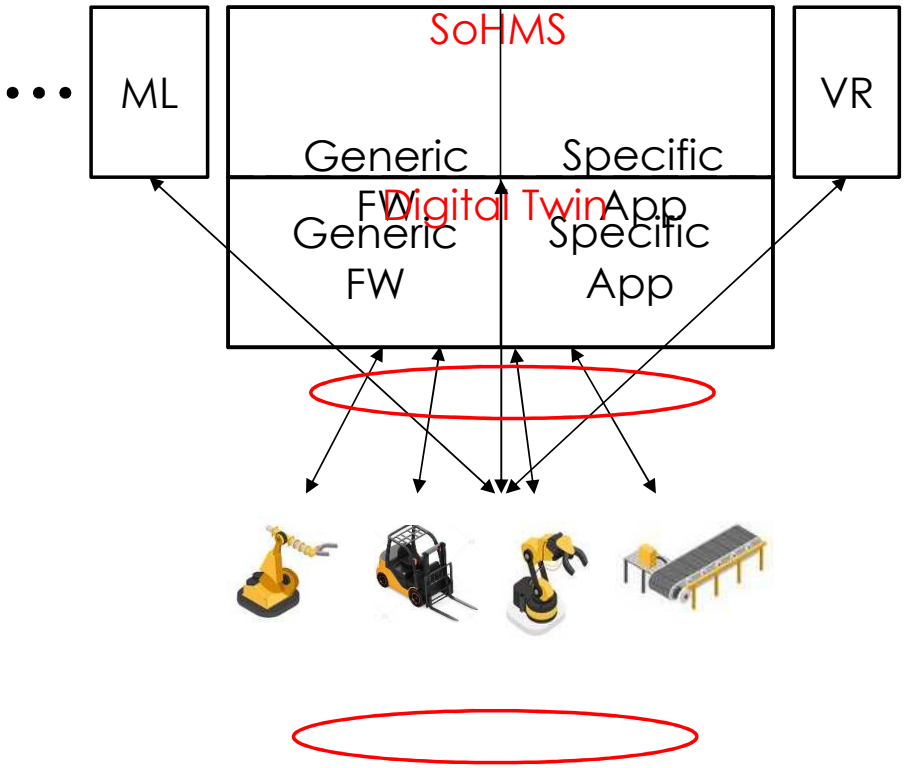
Context and Problem statement (3/3)

- Step 2: Ongoing work
- Requirement of a communication handler for :

  External communication

- Proposed solution : MPCT (Multi Protocol Communication Tool)

  ⟶ which architecture ?



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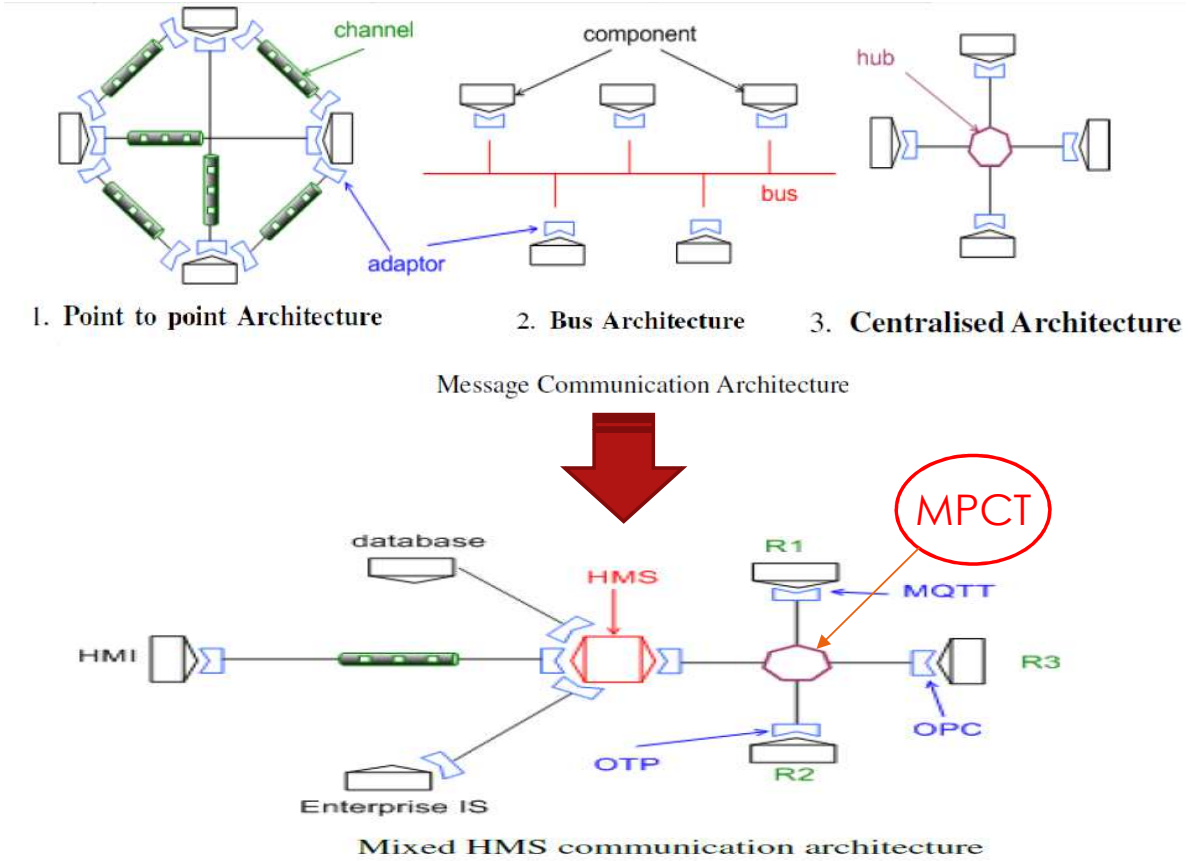
Focus on heterogeneous communication protocols

- Architecture 2:

  Efficient broadcast but weak heterogeneity

- Architecture 1 & 3:

  Good heterogeneity



Hohpe, G., Woolf, B.: Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions. Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA (2003)

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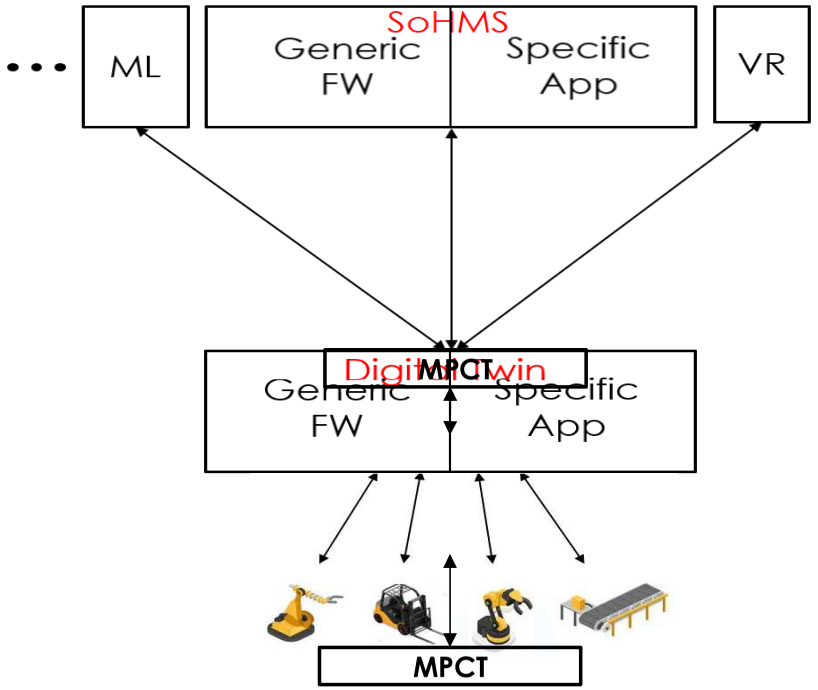
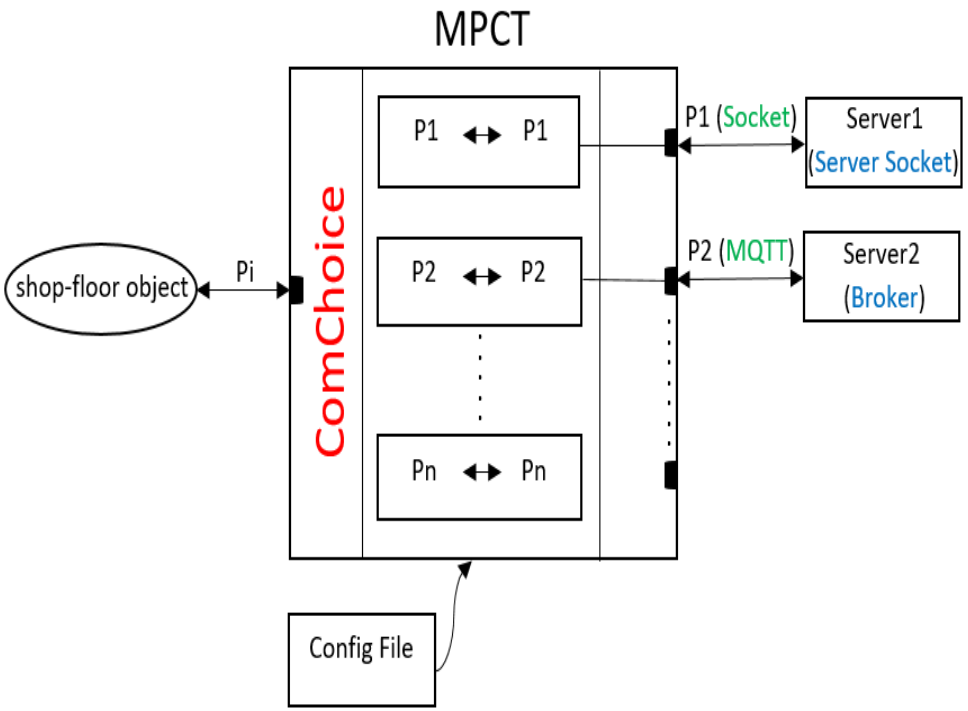
MPCT Handler (1/2)

- MPCT ⇔ (1 to N) communications



MPCT Handler (2/2)

- MPCT strategy :
  - 2 inputs : shop-floor objects and a configuration file
  - Reading of the configuration file
  - Instantiation of ComChoice (conf, Object)
- Easy modifying of the protocol and Objects communication type



Application Architecture

Outline

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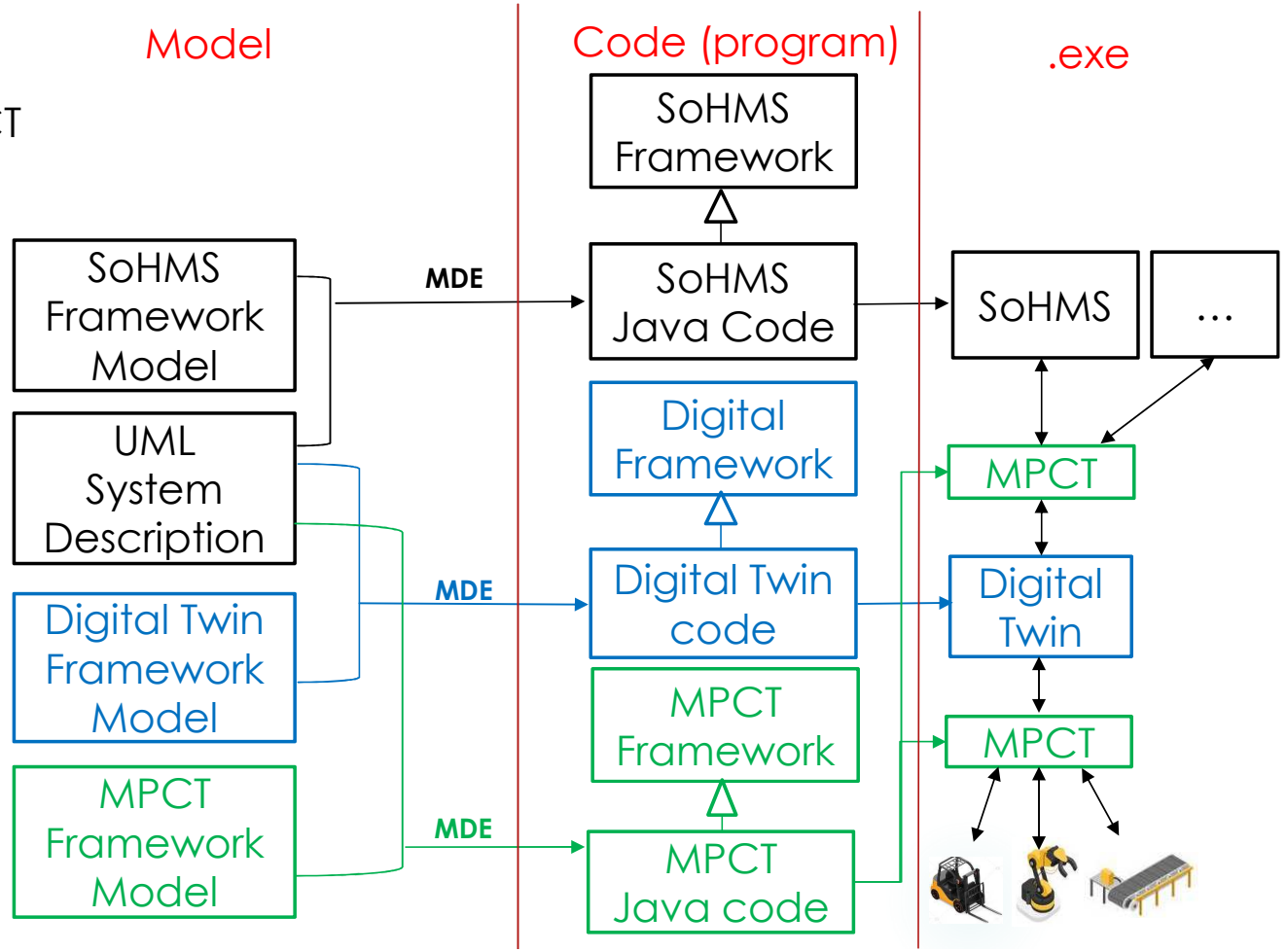
Back to the Overall Approach

- Digital Twin and MPCT generalization



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Conclusion and future works

- MPCT is an innovative proposition to handle communication heterogeneity
- The important thing also in such tool is the evolutivity

- The next stage is to integrate the MPCT in the SOFAL application
- More protocols

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Thank You