COCOP: Architecture and system integration

Project:
Coordinating Optimisation of Complex Industrial Processes

Project website: *www.cocop-spire.eu*

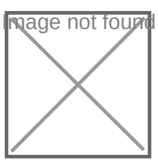
A complex industrial plant comprises continuous and/or batch unit processes where the complexity stems from its dynamic properties. In order to achieve an economically and environmentally efficient operation of a plant, the objective of the COCOP project was to **enable plant-wide monitoring and control by using the model-based, predictive, coordinating optimisation concept in integration with local control systems.**

The project also combined technological and **social innovation within a common co-creation process** in order to improve effectiveness and impact of the innovations, their implementation process and user's acceptance.

The implemented solutions were tested in **two industrial scale tests**: in a **steel** and in a **copper plant**. The test cases validated the requirements and the developed solutions. The quantitative results provided good evidence that these approaches can enable to achieve the objectives and **provide considerable economic benefits** when the solutions have been developed to the TRL 9 level.

The COCOP general concept can be applied to any large industrial production site because it relies on general methods such as modelling of dynamics, data analysis and optimization. Thus, the project also analysed the transferability to other three sectors: Wastewater Treatment, Chemical and Glass Manufacturing sectors.

COCOP was a collaborative 42-months SPIRE project (October 2016-March 2020) and the consortium consisted of 12 partners (5 research organisations and 7 companies), from 6 European countries**.** This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723661.



Sector:

Chemicals

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Engineering

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Non-ferrous metails

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Steel

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Water

Summary:

Industrial process monitoring and control applications consist of heterogeneous systems that need to exchange information in plant-wide setups. An architecture was designed that loosely couples systems in an asynchronous manner to alleviate the issues with point to point connections and to improve utilisation of data from various sources when implementing the plant-wide monitoring and optimised control. A message bus based approach was developed and data flows were defined between COCOP system components and other existing systems, e.g. DCS or SCADA. The architecture developed is based on a data-driven and event-driven style, i.e. those activities dependent on new information react to new data and events made available (on a common medium) in contrast to direct system invocations. The arguments for this design are scalability, decoupling message producers and consumers, reducing direct system integrations, making data more easily available and facilitating building of new monitoring and control applications. The architecture was successfully validated and demonstrated in laboratory settings and in the run-time implementations for the two pilot cases of the project (steel and copper cases).

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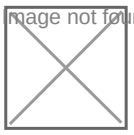

Theme:
Plant-wide monitoring - SPIRE02-2016
Keywords:
systems integration, systems architecture, software architecture, communication protocols, interoperability, plant-wide, process control, model-predictive control
Type:
Video
Document
Poster

Presentation

Resources

Upload Files:
cocop_poster_architecture.pdf
cocop_software_architecture_description.pdf
Link:
Architecture presentation video

- Architecture poster
- Architecture presentation video
- *Report:Software architecture description for the runtime system*
- Papers:
  - Kannisto P. and Hästbacka D. "*Asynchronous Communication Platform Concept to Coordinate Large-scale Industrial Processes*". INCOM 2018 - 16th IFAC Symposium Information Control Problems in Manufacturing. 11-13 June 2018 in Bergamo (Italy). IFAC-PapersOnLine, Vol. 51, no. 11, pp. 1403-1408, 2018.doi:10.1016/j.ifacol.2018.08.325
  - Hästbacka D., Kannisto P. and Vilkko M. "*Information Models and Information Exchange in Plant-wide Monitoring and Control of Industrial Processes*". KMIS 2018 - 10th International Conference on Knowledge Management and Information Sharing. 18-20 September 2018 in Seville. In Proceedings of the conference, volume 3, 2018, pp. 216-222. Doi:10.5220/0006960602160222
  - Hästbacka D., Kannisto P. and Vilkko M. "*Data-driven and Event-driven Integration Architecture for Plant-wide Industrial Process Monitoring and Control*". IECON 2018 - 44th Annual Conference of the IEEE Industrial Electronics Society. 21-23 October 2018 in Washington DC (USA). Doi:10.1109/IECON.2018.8591323

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