Abstract

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Assessment of Interoperability in Cloud Manufacturing

Cloud manufacturing is defined as a resource sharing paradigm that provides ondemand access to a pool of manufacturing resources and capabilities aimed at utilising geographically dispersed manufacturing resources in a service-oriented manner. These services are deployed via the Industrial Internet of Things (IIoT) and its underlying IT infrastructure, architecture models, as well as data and information exchange protocols and standards. In this context, interoperability has been identified to be a key enabler for implementing such vertically horizontally integrated cyber-physical systems for production engineering. Adopting an interoperability framework for cloud manufacturing systems enables an efficient deployment of manufacturing resources and capabilities across the production engineering life cycle. The overarching aim of this research is to investigate interoperability in the context of cloud manufacturing to identify the key parameters that determine whether or not a change-over from cloud manufacturing that deploys traditional g and m codes to interoperable cloud manufacturing is financially viable for a given scenario of service providers and manufacturing orders in a cloud manufacturing set up. The interoperable framework described in this thesis entitled, Cloud Manufacturing Resource Sharing (C-MARS) enables error-free and non-ambiguous information transfer between the various components and layers of a typical cloud manufacturing system. C-MARS is based on the STEP-NC (ISO 14649) standard for product data exchange. The Interoperable framework captures the key operational steps and processes of both cloud-based manufacturing processes and thus forms a basis for further investigating the behaviour and significance of parameters in response to a given production scenario. Building on this, an activity-based deployment model (C-MARS-ABM) is proposed to simulate and further compare interoperable and non-interoperable cloud manufacturing scenarios for production parts of different complexity, varying production numbers, and manufacturing service composition setups typical to SMEs of varying sizes. The results of this research confirm that interoperable cloud manufacturing systems cannot be considered a one-size-fits-all option. Rather, its applicability depends on a number of driving parameters that need to be analysed and interpreted to determine whether not it provides a financially viable alternative to cloud manufacturing without an overarching interoperability framework.