The subject of this PhD dissertation is architecture-centric design and the description of production system architecture. Companies are facing demands for the development and production of new products at an ever increasing rate, as the market life of products decreases and the rate at which customers demand new product features and performance accelerates. Many of these companies are seeking to keep pace with market demands and the pressures of low cost production in other countries by adopting an architecture-centric or platform based approach to the design of their production systems. As companies seek to put the architecture at the center of design activities and let it be a focal point throughout the system life-cycle, they discover a need to change their view of the system design and how they handle it. Applying an architecture-centric approach to production system design requires a proper understanding of the architecture phenomenon and the ability to describe it in a manner that allow the architecture to be communicated to and handled by stakeholders throughout the company. Despite the existence of several design philosophies in production system design such as Lean, that focus on the underlying principles of a production system’s design; and despite the existence of established architecture and platform theories and practices within product design, there is still a need for a better understanding of the architecture phenomenon itself, and certainly how it applies within production system design. This research contributes to the vocabulary and understanding of the architecture phenomenon. A conceptual framework is provided which allows for conceptualization of the architecture phenomenon, and how it applies within production system design. To aid the companies in the operational design and handling of production system architecture, research is conducted into the description of production system architecture, including what an architecture description contains in general and what it should describe for production systems specifically. The contribution in this area of research consists of three parts. First, a conceptual model of architecture descriptions is established based on the ISO/IEC/IEEE 42010 standard. Secondly, the stakeholders and architecture related concerns of relevance for descriptions of production system architectures are investigated, and requirements for the descriptive capabilities of production system architecture descriptions are formulated. Thirdly, a reference architecture framework is suggested. The reference architecture framework will allow system stakeholders to describe the architecture of production systems based on a common set of viewpoints. The viewpoints provide a set of model kinds to frame select architecture related concerns relating to the production capability and the design of the technical system. With the contribution to architecture description there follows a need to support exchange and processing of architecture information within a diverse set of stakeholder domains and tools in the production system life cycle. To support such activities, a contribution is made to the identification and referencing of production system elements within architecture descriptions as part of the reference architecture framework. The contribution consists of a reference designation system based on the ISO/IEC 81346 standard series. The system allows for identification and referencing of the system elements through identifiers generated based on the compositional structures present in the production system.

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