Position statement

Dagstuhl Seminar on Discrete Event Logistics Systems

Martin Grunow

Viewpoint on "Grand Challenges for Modelling Discrete Event Logistics Systems"

It is true that a huge variety of specific modeling tools exists. They are primarily used to design and improve discrete event logistics systems. However, even before we consider linking these type of systems to standard software doing the planning or scheduling, we need to resolve some issues related to the modeling of complex discrete event logistics systems.

Complex discrete event logistics systems can regularly not be modeled with analytical approaches. However, alternative approaches such as discrete event simulation result in models with a complexity which is hard to manage. The validity and implications of the numerous modeling assumptions which need to be made during the often very time consuming model building process of these models are hard to judge even by experienced modelers. Moreover, numerous real-time decision making processes need to be incorporated in the models. An analysis of the interdependences between the procedures used in this context can be extremely difficult. Hence, also an alignment of procedures to improve system performance is hard to achieve, especially, when control software of equipment manufacturers is incorporated in the models, of which the details are unknown to the analyst.

An integration of modeling tools for discrete event logistics systems with standard information systems like Enterprise Resource Planning (ERP) systems, Advanced Planning and Scheduling (APS) systems, or Manufacturing Execution Systems (MES) would primarily aim at improving planning quality by basing the planning decisions on more accurate models of the logistics system. However, the logic of these planning systems is generally not geared to such to the level of detail at which traditional discrete event logistics systems models operate. Moreover, these standard systems usually work with deterministic data, which is also contrast with many discrete event logistics systems modeling approaches.

On the other hand, discrete event logistics systems models could also help in adjusting logistics short-term control mechanism to the planning results of the standard information systems.

What needs to be done to address these challenges?

More research is required in managing complexity for large models of discrete event logistics systems.

In particular, we need to develop approaches
- which support the systematic analysis of distributed real-time decision making made in complex discrete event logistics systems (partly possibly by undisclosed algorithms),
- which aim in systematically improving the procedures used for real-time decision making with the aim of advancing overall system performance,
- which help in investigating the interdependence between planning approaches (used for example in APS) and real-time decision making modeled in discrete event logistics systems.

One of the challenges in integrating discrete event logistics systems modeling approaches with standard information systems lies in finding aggregation mechanisms which transfer the results of discrete event logistics modeling systems to these information systems. This may include a transition from the stochastic to the deterministic world.

How do you see yourself contribute to addressing some of these challenges?

The work is primarily based prototypical industrial cases and aims at

- illustrating how an alignment of real-time decision making procedures can be achieved.
- showing the necessity for coordination between the planning approaches used in standard information systems and real-time decision making,
- developing exemplary aggregation schemes which link discrete event logistics systems models with standard planning systems. For this purpose optimization techniques are used in combination with discrete event simulation.