Aligning the Operations of Barges and Terminals through Distributed Planning
Albert Douma – University of Twente

Summary:
In this thesis we consider the barge handling problem, which is about the alignment of barge and terminal operations in a port. Complicating factor in tackling this problem is that centralized planning is not acceptable for the parties concerned.

In our research we explore an alternative: distributed planning. We develop a Multi-Agent system (MAS) consisting of barge operator agents and terminal operator agents. We propose a specific interaction protocol based on service-time profiles through which barge and terminal operators are able to improve their planning.

To evaluate the performance of our MAS we conduct simulation studies. In this way we get insight in the performance of the system as a whole as the result of the interactions of barge and terminal operators. Additionally, we compare the performance with an off-line benchmark, resembling central coordination.

Our findings are promising. Our interaction protocol supports an efficient negotiation between barge and terminal operators. Our MAS allows for real-time alignment of barge and terminal operations such that the overall system performance is well within the range of central planning performance. Moreover, our MAS suppresses the propagation of disruptions, making the operations of barges and terminals more reliable.

Experiences with the management game that we designed to explain our solution to practitioners, are encouraging and indicate that our MAS may be acceptable for barge and terminal operators and implementable in practice.

Throughout the thesis we took the Port of Rotterdam as our source of inspiration, although our model is applicable to general multi-terminal, multi-barge settings. Generally we conclude that our Multi-Agent system is a promising solution for the barge handling problem and can result in a significant improvement in practice.