The new Physical Internet paradigm for supply chain management is presented as a valid alternative to achieve economically, environmentally and socially efficient and sustainable transportation and distribution of goods. This new approach to the supply chain management entails a major shift in logistics systems, with implications throughout the supply chain, which has direct impact on the way operational research problems are currently addressed. Many of the problems studied by Operational Research will have to be revisited to allow their replication in this new Physical Internet paradigm. Aware of this new reality, this paper presents a state-of-the-art survey on Operational Research problems in the Physical Internet. The review considers papers published between 2009 and 2018 and it is intended to be a starting point on the classification of the OR problems within the Physical Internet paradigm, aiming to identify opportunity areas for future research.

2 - Simulation-based optimization approach for PL-networks

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Physical Internet (PI) aims to connect single logistics network together, to create an open and global transportation network. Within the opening and globalization, the networks complexity rises through the consideration of many restrictions. Due to the high complexity of such networks special methods have to be developed to solve this kind of complex problems. One already known approach to solve such a task, is simulation-based optimization. Simulation-based optimization combines the two phase’s optimization and simulation with each other, whereas the optimization is used to generate valid solution candidates, which are evaluated through the simulation. Due to the intricacy of the networks, metaheuristics are used for the optimization process. Based on the already known problem representation a new problem representation of vehicle routing for PI-networks containing a new date encoding was developed. For the creation of solution candidates, a genetic algorithm is used and therefore some new manipulation methods, which are suitable for the new data-encoding, have been implemented. Since a PI-network is a complex system with many nodes of different types, the simulation has to evaluate the candidates from the optimization step in a reasonable time. Therefore, a new algorithm for the simulation step was developed. This new approach lacks a bit of intelligence, but is more time efficient than a conventional simulation.

3 - Physical Internet: A study of the Containers Layer in the NOLI Reference Model

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The goal of a Physical Internet is to be a sharable, more efficient, logistics network. The NOLI Reference Model for a Physical Internet is a Reference Model, inspired by the OSI Reference Model for data networks and Internet. A reference model divides the complexity of the whole problem into easier sub-problems. As the OSI model, the NOLI model includes 7 layers (Colin 2017). These layers are, from layer 1 at the bottom, to layer 7 at the top: the Physical Handling Layer, the Link Layer, the Network Layer, the Transport Layer, the Order Layer, the Container Layer and the Product Layer. A first model, named OLI, was proposed in 2009 by Montreuil et al (Montreuil 2009). It also included 7 layers. Its Layers are somewhat different from the ones in the NOLI model. In this presentation, we study more precisely some functionalities of Layer 6, the Container Layer. We present its goal and location in the NOLI model, some of the software and material services it must provide, and the relationship it has with Layer 7 above, and Layer 5 below it. It also includes some algorithms to manage the handling of the imbalance in specific containers (Colin 2015). We compare it with the TCP/IP, the OSI and the OLI Reference Models.