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BOOK OF ABSTRACTS

Towards a Unifying Framework for Self-Organization in Transport Logistics

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Abstract. This presentation gives voice to the call of both researchers and practitioners to establish a common ground and typology for self-organization in transport logistics. The presentation focuses specifically on vehicle automation and how delegation of control – or autonomy – to these vehicles, may result in various forms of self-organizing logistics. This is motivated by the lack of clear vision amongst researchers and practitioners on what automation and autonomy bring from a logistics point-of-view and how it is related to self-organization in the transport logistics domain. Contrary to established literature, typologies and classifications, the focus is not on a single-vehicle perspective, but rather a holistic perspective is taken on how automated vehicles impact logistics processes and how they may affect the hierarchy of control, and specifically how decentralization plays a role towards self-organizing systems. Since there is some ambiguity around the notions of automation and autonomy, both in literature and practice, and in particular around the question of how they may lead to a self-organizing logistic system, this presentation touches upon these notions first. Based on this discussion a clear distinction is made between manually organized logistics and self-organizing logistics. A visionary approach to the latter category is then presented.

Key in this approach is the interplay between the degree of autonomy of logistic systems and their degree of cooperativeness. On these two pillars, a unifying framework is presented, distinguishing four fundamental categories of self-organizing logistics. To illustrate the working of the framework in practice, we present four real-life case studies, one per each category. The case studies are positioned as-is, and concrete directions for (more) self-organization are presented for each case. Moreover,

Monday, Sept. 28, 13:30-15:00; Session: Collaborative Freight Transport

possible additional dimensions of the framework, e.g., control hierarchy, system intelligence, connectivity, and predictability are discussed.

The usefulness of the framework established is two-fold: (i) it provides a common ground for researchers to position their work and to identify potential future directions for research and (ii) it serves as a practical and understandable starting point for practitioners on investigating how self-organization may affect their business and where their limited resources should be focused upon.

Keywords: Self-Organization, Logistics, Transport, Autonomous Vehicles, Framework