Matthias Prandtstetter(1) / Lisa-Maria Putz(2) / Sarah Pfoser(2) / Alexandra Haller(2) / Gernot Lenz(1) / Wolfgang Ponweiser(1)

(1) AIT Austrian Institute of Technology, Mobility Department – Dynamic Transportation Systems

(2) University of Applied Sciences Upper Austria

# Introduction to Synchromodal Networks in Austria

## 100 Physical Internet – Ein neues Paradigma für effiziente Supply Chain Netzwerke

Abstract

Within this work, we present a novel transportation concept called synchromodality. The underlying key element of synchromodal networks is, among the fact that multiple modes of transport are available, that at any time and at any point in the transportation process pre-made decisions can be refused and changed based on real-time traffic information. After a short definition focus is laid on the suggested Austrian approach towards synchromodality. Recommendations on how to introduce synchromodality (in Austria) are presented, which have been gathered during a study visit in the originating country of synchromodality, the Netherlands.

Keywords:

Synchromodality, Physical Internet, Austria

## 1 Introduction

According to the European Commission about one-fifth of Europe's $CO_2$ emissions are produced in road transport (European Commission 2015). Even worse, road transport is the only main sector with rising $CO_2$ emissions. It is therefore fundamental that counter measures have to be taken. As documented in (European Commission 2001), the European Commission addressed the need for a higher percentage of eco-friendly transport modes in European's modal split. The main idea was to shift (freight) transportation from road to railway. After a relatively short period it turned out that more than a pure shift off road is needed leading to the concept of comodality which was established in the Commission's interim report (European Commission 2006). In short, comodality denotes the mental shift towards optimized use of different transportation modes. In (European Commission 2011), the Commission finally stated a goal of 50% of all (passenger and freight) transport to be shifted towards rail and waterborne transport by 2050. Current logistics visions for 2050 even take one step further: they do not only aim to achieve a shift off road but also want to reduce the necessity of (freight) transport and traffic.

One of these visions is the Physical Internet (PI), which relies on modular, standardized transport containers, standardized (transport) protocols and flexible transport networks, e.g. synchromodal networks (Montreuil 2011). However, the PI also comprises the idea to not only optimize the (freight) transportation itself but also optimize the origin of the goods, i.e. find the best suited production or storage site for fulfilling the corresponding demand. Altogether, coordination among miscellaneous freight transports as well as bundling effects can be achieved.

Although the basic vision of the PI is quite convincing, one has to keep in mind that the PI is a vision. In order to reach this vision, five roadmaps have been published by the European technology platform ALICE. Although each of these roadmaps focuses on one individual topic, all of them have to be seen in combination with each other as the realization of just one of these roadmaps will most probably not lead to targeted positive effects. Within this paper, we focus on the topic of the second roadmap (ALICE 2016). Here, the main goal is to achieve sustainable transport via synchronized, smart and seamless corridors, hubs and networks. Assuming that corridors and hubs are already (partly) well established in Europe, we think that it is necessary to combine those into a synchromodal network. Nevertheless, we also think that a pure technological approach with respect to the creation of synchromodal networks is not enough as there are, on the one hand, many additional constraints (like legal issues) which have to be overcome. On the other hand, the acceptance (and use) of a synchromodal network is currently not certain by most of the stakeholders.

The remaining of the paper is organized as follows: In the next section, a definition of synchromodal networks will be given. Thereafter, an introduction to an Austrian research project focusing on synchromodality. Section 4 presents suggestions how to introduce synchromodality in Austria. Finally, we present thoughts on future work in Section 5.

## 2 A Short Definition of Synchromodal Networks

The concept of synchromodality is an evolvement and consolidation of previous (well-known) freight transportation concepts: In multimodal supply chains at least two modes of transportation (MOTs) are involved, cf. (UN/ECE 2001). Comodality comprises the optimized use of MOTs, cf. (UN/ECE 2001). Taking these two properties and adding real-time decision on transportation mode one can come up with the definition of synchromodal networks: Synchromodal networks are transportation networks consisting of at least two (different) MOTs and supporting real-time switching among those MOTs based on optimized mode-choice decisions, cf. also (Putz/Prandtstetter 2015). It is therefore possible to choose among the best options not only in real-time but even in case the goods are already on track. In order facilitate real-time switching among MOTs it is necessary that shippers apply mode-free booking, i.e., instead of defining the MOT during the transportation request, it is left to the transporter who can decide on the best available option. It has to be highlighted that synchromodal transports in synchromodal networks are not necessarily intermodal. It exists, however, always the option to change already made decisions as alternative options are available. A (re)assessment of the options is continuously performed such that finally the best decisions can be made.

To put the idea across, let us present a short example: Shipper S wants to send some products to customer C. For this purpose, S calls transporter T. Instead of specifying typical parameters like departure date and MOT, S only determines important constraints like the latest arrival time. T can now decide at which time the goods are collected at S's factory. Furthermore, T can decide which MOTs will be the best ones. E.g., T decides to collect the container by truck and put it on rail for the main leg. However, shortly before T reaches the rail, it turns out that the train is already full but a nearby vessel has an empty slot. As the schedule of the vessel guarantees that the container can arrive on-time at C's house, T decides to put the container on the empty slot on the vessel (which was available anyway) instead of booking an extra slot on the next train. This, however, facilitates the (extensive) use of vessels as the bundling effect guarantees that the costs of a vessel can be covered (although S has only one container to be transported).

In conclusions, synchromodality can only be defined on (transportation) networks as alternatives and backups are needed to be able to choose in real-time between different options and to allow real-time switching in case of incidents. Beside the real-time aspect, the requirement to operate on a network structure is also the main difference to the more well-established transportation concepts of multimodality, comodality and intermodality. Although all of them can be defined on a network as well, it is not necessary to do so.

## 3 The Austrian Approach

In the Austrian research project "SynChain – Synchromodale Logistikketten" the main goal was to understand the key properties of synchromodality and to extract key enablers (based on literature research and a study visit in the originating country of synchromodality, the Netherlands). This allowed us to identify which actions need to be taken in order to establish synchromodal transportation in

Austria. For this purpose, key enablers were extracted using a method going back to the *critical success factor* method by (Rockart 1979). A detailed description of this approach and the outcome is documented in (Haller et al 2015, Pfoser et al 2015, Putz et al 2015). The final step was to arrange a stakeholder workshop in order to analyze the results and disseminate the concept in Austria.

## 4 Suggestions to Introduce Synchromodality in Austria

Obviously, one key enabler for synchromodality is a proper transportation network. This includes, among others, transportation infrastructure (covering at least two different MOTs) including transshipment infrastructure. Furthermore, a critical mass with respect to freight transportation flows needs to be reached. This can either be achieved via bundling of freight flows or via horizontal or vertical cooperation. In the former case, one transporter is consolidating different requests such that the critical mass can be reached. In the latter case, the critical mass is reached since different transporters (or even shippers) are cooperating.

Our conversations with experts from research and industry suggest that not infrastructure and information systems are considered as the main barriers, but rather cooperation and trust between various companies are the crucial obstacles. Here the PI comes into play again: Focusing on synchromodal networks only without establishing other elements of the PI, it turns out that cooperation among companies has to be achieved on a bilateral basis. I.e., two companies have to have the will to cooperate with each other. Furthermore, they have to come to a cooperation agreement.

Following the vision of the PI, this cooperation among the companies is established without (directly) involving the two cooperating companies as the transports are bundled without their actual knowledge. This can be achieved due to the decentralized and open organization of the PI. In fact, this is similar to already existing situations in today's freight transportation network: two parcels brought to the same transportation company might be forwarded with the same truck even without the two shippers knowing from each other; not to mention both of them having mutual agreements on cooperative transports. While in today's setup, both shipping companies have to (accidently) choose the same transportation company, we expect that in future systems where the transportation mode (and also the forwarders) are not (explicitly) specified by shippers these bundling possibilities will be automatically detected and used.

### 4.1 Inner-Austrian Transports

Although one of the most important European inland waterways is crossing Austria, the Danube is of importance only for the eastern part. Therefore, an inner-Austrian synchromodal network has to rely on rail and road only. Nevertheless, according to the experts interviewed during the study visit in the SynChain project, the Austrian railway network is considered as well established with respect to the introduction of synchromodality (in Austria). Corresponding transshipment nodes (e.g. terminals) are existent as well. Due to large infrastructure projects in the railway sector the Austrian transport network is even more strengthened.

One crucial point is, however, that the concept of synchromodality (and the vision of the PI) is currently not widespread among the Austrian stakeholders. Corresponding programs (e.g. educational activities, informational events, etc.) supporting the introduction of novel logistics and transportation concepts need to be established. Respective activities from the governmental sector (e.g. sponsoring, legislation, etc.) will ease the introduction of synchromodal networks.

### 4.2 Trans-European Transports affecting Austria

As inner-Austrian synchromodal transports are theoretically possible, the main advantage of the synchromodality concepts evolves in long-distance transportation networks. This is mainly due to the fact that the number of effective transportation alternatives is much higher in widespread networks than in geographically limited regions.

With respect to trans-European transports it has to be mentioned that Austria is well connected: on the one hand, multiple TEN-T corridors cross the country. On the other hand, Austria has an important share of the Danube which represents one of the most important inland waterways in Europe. Furthermore, as already mentioned above, the railway network in Austria is well established such that train connections to all major ports and terminals in Europe can be realized.

## 5 Future Work

In order to promote the concept of synchromodality as well as the physical internet, a three-level approach will be endorsed: First, one crucial point is to create awareness. For this purpose, the concept of synchromodality will be included in (university) lectures starting to plant the idea of synchromodality and the PI into the heads of the decision makers of tomorrow. However, also current stakeholders need to be acquainted with these novel ideas and concepts. Therefore, stakeholder workshops and events focusing on the topic PI and synchromodality will be organized.

Second, further research projects in the context of PI and synchromodality will be realized. Different aspects (e.g. network layout, hub configuration, etc.) will be addressed and conclusions drawn will be included in the above mentioned workshops and lectures.

Third and finally, international cooperation will be sought. On the one hand, these are necessary as synchromodal networks will most likely best perform on a multinational scale meaning that a trans-European solution is needed. On the other hand, other countries (like the Netherlands) are already one step further and have first (working) pilots resembling synchromodal networks. It is therefore convenient to learn from the best/first and build on their knowledge. Cooperation with those companies included in synchromodal pilots (in research projects as well as in non-academic pilots) will most probably lead to further developments in Austria.

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