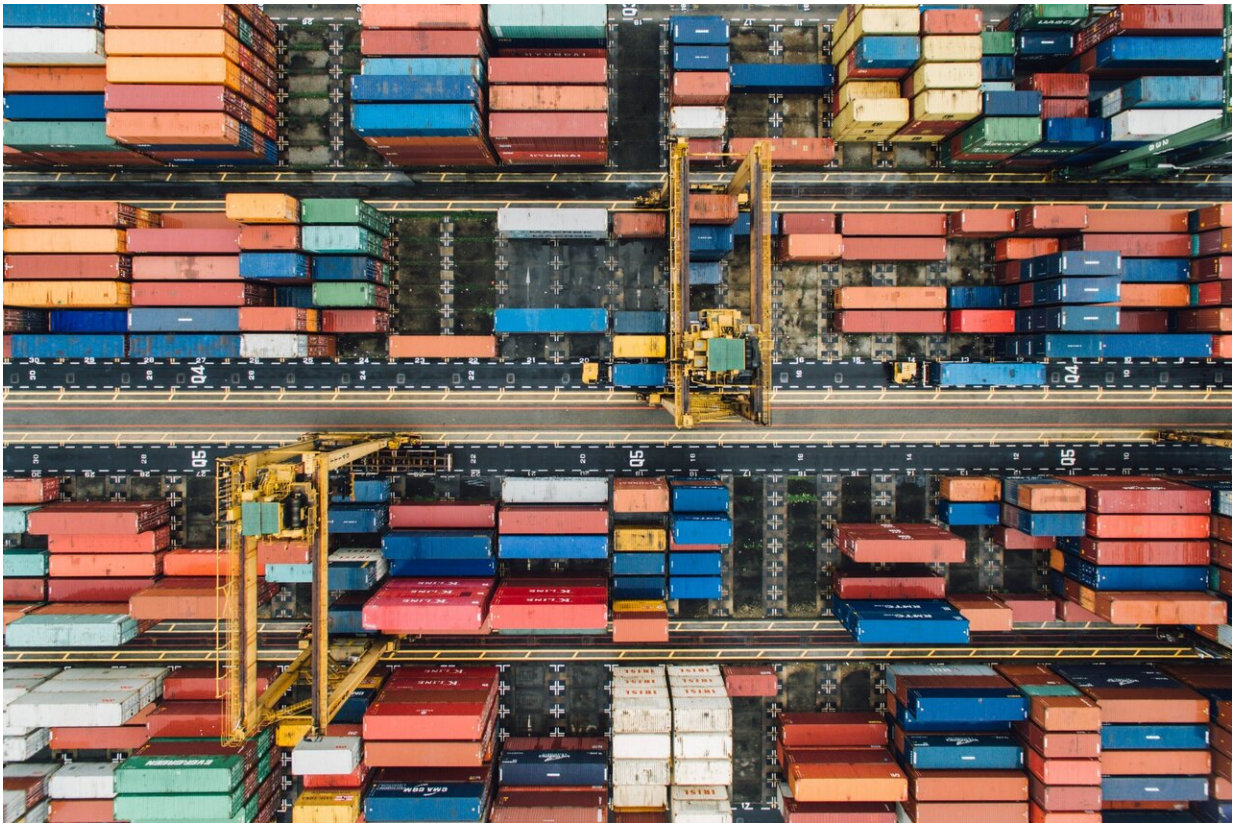
How the 'physical internet' could revolutionise the way goods are moved

February 15 2021, by Sandrine Ceurstemont, Horizon Magazine



According to Marcel Huschebeck, the physical internet could improve the speed of shipments, resulting in faster deliveries. Credit: CHUTTERSNAP/Unsplash

Shipping goods from furniture to food could be transformed by a new transport network called the 'physical internet." It is built on similar

principles to the internet, which revolutionised the way information flows around the word, including open access and global interconnectedness. Researchers hope to make it a reality by 2040, when a fully autonomous network should be in place.

When you send an email to someone across the world, it is usually received quickly and seamlessly. Your message passes through a network of servers until it reaches its destination. But you would not be aware of the route it took.

A physical internet would work in a similar way. Transport and logistics companies would be able to access a network of routes connected by hubs, and involving different modes of transport, which would allow them to streamline how goods are shipped from one place to another.

"It started with the idea that we can move freight around in the same way that data moves in the internet," said Dr. Kostas Zavitsas, a researcher at the Imperial College Business School in the UK.

Transporting goods from one place to another is currently not as efficient as it could be. Vehicles are typically not loaded to their full capacity - on average they are less than 50% full - while trucks may drive back empty after making a delivery. "One of the main problems in the industry today is that the fill rate is not that high," said Dr. Zavitsas. "A higher fill rate would have an impact on costs and emissions and create a much more sustainable system."

Companies also largely operate independently where warehouses and modes of transport are not shared. However, one of the principles of the physical internet is to open them up to everyone, similar to how the internet is built on the concept of open access. Two competitors, for example, would be better off collaborating if they are shipping goods along the same route. "Doing that, resources can be utilised much more

efficiently," said Dr. Zavitsas.

Digitise

In order to create such a network, the first step is to digitise all available information.

Whereas today, a lot of decisions about how to ship cargo are made intuitively, analysing data will be key in the physical internet. Every mode of transport, warehouse and customer location, for example, would have to be recorded electronically, along with real-time information such as traffic congestion, use of ports and bottleneck locations.

The idea is that every element of the network would have a digital twin that could be updated with relevant details, such as how much space is available in a warehouse or the schedules of different modes of transport. Installing sensors will be required to capture some of this data. "We would then take this information and a centralised algorithm will route a container in the optimal way," said Dr. Zavitsas.

As part of the ICONET project, whose goal was to produce a prototype of the physical internet, Dr. Zavitsas and his colleagues found that an optimal route could change depending on a company's requirements.

Whereas some wanted goods delivered quickly, for example, others were more concerned about reliability. In this case, the digitised network could help by identifying ports or warehouses that are less dependable or have uncertain processing times. "It will be possible to reroute or avoid specific locations depending on the demands of each client," said Dr. Zavitsas. "Another powerful characteristic of the physical internet is that it can customise solutions."

Standardisation will also be key to developing the physical internet. At

the moment, cargo from different companies may be of different shapes and sizes so it can be hard to pack them into a truck while making the best use of space. Marcel Huschebeck, chief of logistics research at PTV Group in Karlsruhe, Germany, and his team found that using six different sized modular boxes would cover about 85% of cargo sizes. They made this finding during the first EU-funded research project on the physical internet, called MODULUSHCA, which ended in 2016. Using these boxes would result in cost savings since they improved the fill rate of the cases and the pallets for manufacturers by 15% and up to 50% for retailers.

Standardised containers also make the packing process less time-consuming and digital visualisations can be used to help. "The logistics operator has to play a bit of Tetris," said Huschebeck. "Once you have modular sizes it becomes much easier."

Retailers

The physical internet is likely to benefit some types of companies more than others. In the MODULUSHCA project, which focused on packaged consumer products such as items found in grocery stores, Huschebeck and his colleagues found that large retailers would benefit most from the network since they often combine different types of goods when sending them to outlets. Producers, however, would have to get on board by changing their boxes to standard sizes to facilitate the process .

According to Huschebeck, this could complicate how costs are distributed. The physical internet is likely to have start-up and fixed costs which participating companies will have to cover. Although there will be savings along the whole supply chain, it might be hard to share the benefits equally among all parties involved. Game theory, which involves mathematically modelling the interactions of competitors in social situations, could help provide a solution. "There has been some

research in this field," said Huschebeck. "However, in the end it's a collaborative activity and also a collaborative earning situation which is new for a lot of business operators."

Huschebeck and his team looked at how competing companies could work together and coordinate the transport of goods as part of a project called CLUSTERS 2.0. They focused on logistics hubs such as ports, airports and freight villages, where different companies of the logistics industry are located in close proximity but don't interact. The idea was to see whether they could better cooperate using a communal system such as the one that currently exists in ports, where different stakeholders exchange information about incoming ships and types of cargo for example.

One of the outcomes of the project was a slot-booking web app that can be used by different cargo transport companies to help optimise freight delivery. It was trialled at Brussels airport in Belgium, where the availability of ground handlers that sort different types of freight can be checked and time slots can be booked. Using the app helped reduce waiting time, which in turn resulted in cost savings for companies, while it also helped ground handlers with air freight cargo scheduling and personnel planning.

Customers

The physical internet is likely to have benefits for customers too. A company's goods are currently sent to a primary distribution centre from where they are shipped to outlets. But with the physical internet, the storage of goods would be decentralised, which should allow shipments to be delivered faster. "You can possibly get much closer to on-demand (deliveries)," said Huschebeck.

Dr. Zavitsas thinks there could be cost savings for consumers too as a

result of a more efficient service. And greener credentials are likely to appeal to many EU consumers, who consider the environmental impact of products to be the third most important factor when deciding to make a purchase. There are a lot of emissions benefits from driving much more efficient transport operations that use multiple modes, such as road and rail, he says.

The next challenge will be to see how the physical internet could be implemented globally. So far, Dr. Zavitsas and his colleagues have been focused on specific transport corridors and hubs in Europe. But as part of the PLANET project, which started in the middle of last year, they will now look at how to create a much larger-scale network, that would allow freight to be transported efficiently between Europe and China, for example.

They would like to incorporate the Silk Road, a network of land routes that connect China to the Middle East and Europe, into the physical internet and are investigating what information would be required to do so efficiently. Different modes of transport will have to be integrated as well, from planes to rail to inland waterways. "The level of operation and planning that is required is quite overwhelming sometimes," said Dr. Zavitsas. "But I think this level of complexity is needed to eventually drive better solutions."

Provided by Horizon: The EU Research & Innovation Magazine

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