

Digital Infrastructure for the Physical Internet: Perspectives and Issues

White Paper

Bill Karakostas

VLTN BBVA

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In this white paper we outline the core functionalities and expectations for a digital platform for the Physical Internet (PI- π), motivated by how things currently operate in the existing Internet.

1 Setting the Scene

Physical Internet (PI) is a concept/vision for Transport and Logistics (T&L) that is intuitively appealing and gradually gaining traction. But it is far yet from achieving mass adoption.

PI is a mixture of the physical and digital technologies and of new processes/ways of working in T&L.

In principle, physical Internet (like the T&L domain in general) can be realised with little or no ICT. But in practice, many of the characteristics of PI will be very cumbersome or simply impossible to implement without ICT.

In this position paper we outline a vision for a ‘digital platform’ to enable PI. But questions immediately arise: Who will be the owners and the users of such platforms? What will be its role? What will be its relation to existing (digital) logistics platforms and other enterprise IT systems for logistics?

What will be required for this platform to achieve wide enough adoption in the industry?

2. Internet Points of Presence

As Internet currently is a technology that is accessible to all, PI in the future needs to be accessible to all actors in T&L, in order for it to justify the use of the word ‘Internet’ in its name.

However, in the current Internet, everyone is a participant, but not everyone possesses the same means and systems. There is a distinction between *Internet users* and *Internet service providers*.

The vast majority of Internet participants are users and do not possess particularly extensive (or expensive) ICT infrastructure to connect to the Internet. They depend instead on Internet Service Providers (ISPs).

According to Wikipedia:

‘A point of presence (PoP) is an artificial demarcation point or interface point between communicating entities. A common example is an Internet point of presence, the local access point which allows users to connect to the Internet with their Internet service provider (ISP).[1] A PoP typically houses servers, routers, network switches, multiplexers, and other network interface equipment, and is typically located in a data center. ISPs typically have multiple PoPs. PoPs are often located at Internet exchange points and colocation centres.’

By drawing an analogy from the concept of PoP, in the future, most PI participants will be *users* and will participate in PI through PI PoPs. They will not require especially sophisticated or expensive ICT equipment to do so.

On the other hand, a smaller core of PI participants will form a *core* for a physical PI digital backbone, similar to how a small number of telcos (and big ISPs) together form the backbone for the Internet.

These PI infrastructure providers will be associated one way or another with the nodes/hubs of the PI, e.g. the major intermodal terminals that will become in the future PI nodes. The possible collaboration scenarios are several: The PI hub itself can provide and manage (its part of) the digital infrastructure for the PI. Or, it can assign it to a third party such as an ICT services company, a telco etc. Pretty much as it happens today with the current Internet.

3 PI Service Brokers

In the future PI, not everyone will be a large ISP, node/hub or a user. In the current Internet, many ISPs are smaller players who buy resources from the larger ISPs and sell them on as services to their customers.

In the future PIs, such brokers can become a future version of current logistic brokers/freight forwarders etc. They will be the means to reach out to more of the T&L market and can differentiate from each other by offering value adding services to their customers.

So, the future PI will be tiered, as the current Internet is now. A PI backbone will exist with direct connections between the PoPs that will correspond to the main PI hubs. And there will be tiers of smaller PI service providers that will eventually help all T&L customers (the ‘shippers’) connect to the PI.

4 Imagining the role and scope of a Digital Platform for PI

Clearly PI will require ICT technologies targeting different types of users with different functionalities purpose and technical characteristics

As for example, in the current Internet, the consumer modem/router device serves a similar role to the digital routers and switches that exist in the Internet backbone centers. However, the scope, functionality, cost performance etc of the consumer and industrial Internet equipment are totally different.

Clearly, from the above there needs to be more than one platform types addressing the different tiers of PI participants.

For starts, the end users of PI (the ‘shippers’) are unlikely to have direct control and influence on how PI operates, same as the current user of the Internet does not know (or care) how it works. Of course, very large PI users/shippers will have direct connections to the PI connecting directly to it rather than PoPs, same as it happens today with major users of the Internet.

PI service providers will also customer focused but lacking the resources to participate directly in the PI backbone, buying instead services from the main PI service providers. They will require platforms to manage both ends of their business, the PI consumers/shippers and the PI backbone.

Finally, the providers of the PI backbone (‘PI infrastructure’) will also need platforms to both connect to the physical PI service providers (the terminals/hubs) and to each other. They will also platforms to manage the part of the PI network they own and control.

Of course, a PI backbone (digital) service provider can have multiple PI backbone participants as customers, in the same way that a telco or large ICT service providers has several major customers.

Then, for its own customers at least the PI backbone (digital) service provider can have its own digital platform for managing its customers and the services it provides to them, and for looking after its own segment of the PI.

4 Conclusions- further questions and thoughts

As today no one owns the Internet, in the future it is unlikely to expect that one or a small group of players will own the entire PI. Of course some will be very influential, namely those that represent major PI nodes/hubs. Those also who will own the technologies to connect the PI hubs to each other will be very influential. Of course, as the main protocols for PI connectivity will hopefully be open (as it is the case now with the current Internet), everyone in principle can establish the digital systems to become a PI node and connect to other nodes. But this is where things differ from current Internet, as in the PI the participants (at least of Tier-1) must also have the physical counterpart that will offer the actual physical PI T&L services (the storage, transshipment etc).

Finally, we have the smaller (i.e. Tier-2) PI (digital) service providers that will care more about the shipper side and who will have the technologies to connect to the PI backbone via one or more Tier -1 providers.

The smaller shipper as we said will connect to PI via a Tier-2 provider, while the larger one via a Tier-1 or even will be a Tier-1 provider itself.

All these considerations open up questions for the scope and purpose of the ‘Control and Management Platform’. Who are these platform owners? What is its scope? What is its role and position w.r.t to other platforms and systems, both PI and non-PI ones in a future PI.

A platform targeting a Tier-1 PI player will have a very different scope and nature than a Tier-2 platform. Most likely however, they will all be cloud-based as the provider of digital PI services will be wanting to easily scale up its services, whether it is a cloud in its own data centres or a public cloud.

A platform for the Tier-1 players will need to have more broad scope of functionalities than a Tier-2 targeted platform but also to operate more according to the agreed PI connectivity protocols and standards. Without these, now PI can be realised, only point to point connections.

Core PI connectivity protocols relate to a Tier-1 platform functionality is tacitly been envisaged. So one way to see the ‘Control and Management Platform’ envisaged in WP2 is as the machinery (both hardware, networking and software) run currently on the Internet backbone centres.

But we have to bear in mind that this will be only one of the several platforms that are expected to be deployed as the PI starts to grow.