i4Trust

GlobShare

Data Spaces for Breakbulk Logistics

Data Spaces for Breakbulk Logistics

Creating a Data Space for the breakbulk industry, where different transport companies and intermodal terminals can easily and safely share operational data will bring this industry substantial efficiency gains and full transparency
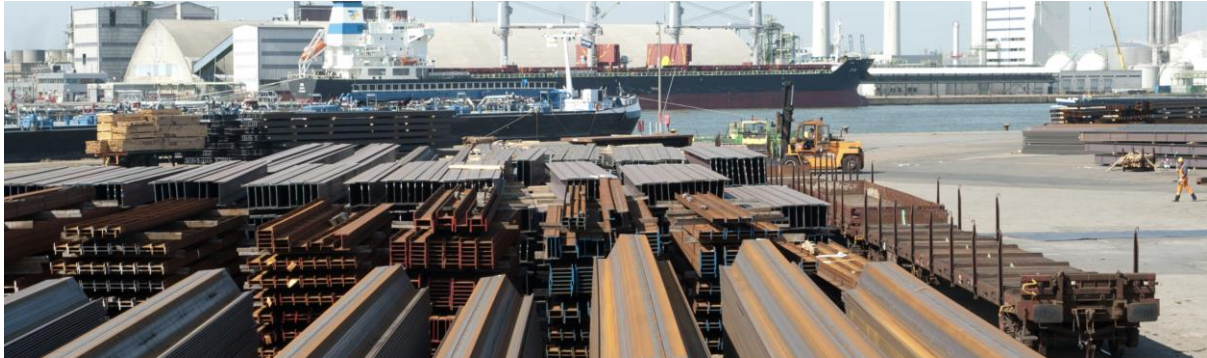
With the contribution of:

Digital Innovation Hub

Challenge & Context

The supply chain of *breakbulk* is characterized by inter-modal transport, specific storage and handling requirements and a lot of sub-contracting. There is hardly any data or integration standard and a large part of the industry still works with paper documents and email exchange.

Break bulk cargo, also called general cargo, is goods that are stored and transported in individually counted units, and not through the use of shipping containers

Although data and integrations standards are ubiquitous in the consumer packed goods space (eg. GS1) and in container transport (eB/L, DCSA), break bulk is characterized by the divers, unstandardized nature of the cargo and very specific requirements of shippers and consignees.

The breakbulk industry lacks the attention of large software providers and international organisations because:

- Breakbulk only makes out a small portion of global supply chains,
- The diversity of the cargo, transportation modes and handling instructions makes it difficult to create a scalable (software) solution
- Breakbulk logistics requires still a lot of manual handling and breakbulk LSP's (Logistics Service Providers) have been focussing primarily on optimizing the physical handling

This causes the industry to work years behind others when it comes to data sharing and efficient supply chain collaboration. Therefore, the breakbulk industry misses visibility on disruptions, damages, delays and its back offices work inefficiently, relying on phone calls, mails and spreadsheets.

The supply chain of industrial steel coming from big steel factories (eg. ArcelorMittal) and shipped to construction companies throughout the world, is also a different game than the supply chain of raw coffee beans in big bags, from

its country of origin to large coffee producers like Nestlé. Both are breakbulk, but the cargo has different attributes, the documents used to transfer ownership are different, the handling is different, let alone storage requirements, quality checks and so on.
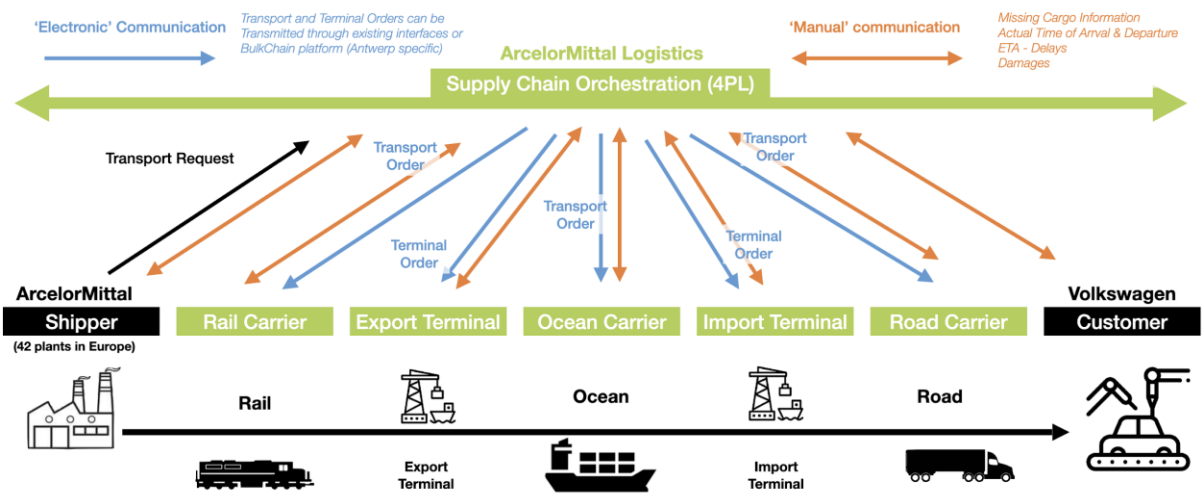
The organization of shipping steel to end-customers involves many parties and a lot of informal communication.

Matrix which data flows between the different supply chain roles

Solution

Globis and its partners believe firmly that <u>specific</u> 'Data Spaces' for <u>specific</u> breakbulk supply chains, could eliminate most of the practical and technical obstacles to share data and optimize insights and processes.

Such data space should contain a suitable digital twin for:

- <u>The Cargo</u>, and its specific attributes, packaging and markings
- <u>The Transport and Handling Instructions</u>, per storage and transport modality
- <u>The Proof of Condition</u>, at arrival and/or at departure, for every transport leg and modality
- <u>The Proof of Delivery</u>, at arrival of each transport leg

One should notice that the exchange of orders and invoices between all parties involved is also a part of a digital process with its own digital twins.

In this experiment, though, we leave the order exchange to existing platforms and the links to these platforms will be part of the attributes for each specific data space.

In the case of breakbulk, the Port of Antwerp has created BulkChain, 'a collaborative platform built on NxtPort technology, dedicated to build the Breakbulk port of the Future'. GlobShare is in no way intended to replace BulkChain or become a competitor. It is entirely complementary and NxtPort/BulkChain is even a contributor to this experiment.

GlobShare will build further on the first BulkChain use case where transport and terminal orders are exchanged between shipper, transportation companies and port terminals, using BulkChain. GlobShare will add much richer cargo data and events from the hinterland terminals (rail, barge, etc,)

With this GlobShare experiment, companies in the data space can quickly create shareable data objects, specific for their industry, and link them seamlessly to BulkChain transactions. And where Bulkchain is more focused on transaction data, including authorities and customs etc. in the Port of Antwerp, GlobShare will share:

- real time information on the cargo's state and location
- relevant hinterland events that could lead to lead time deviations, damages etc.
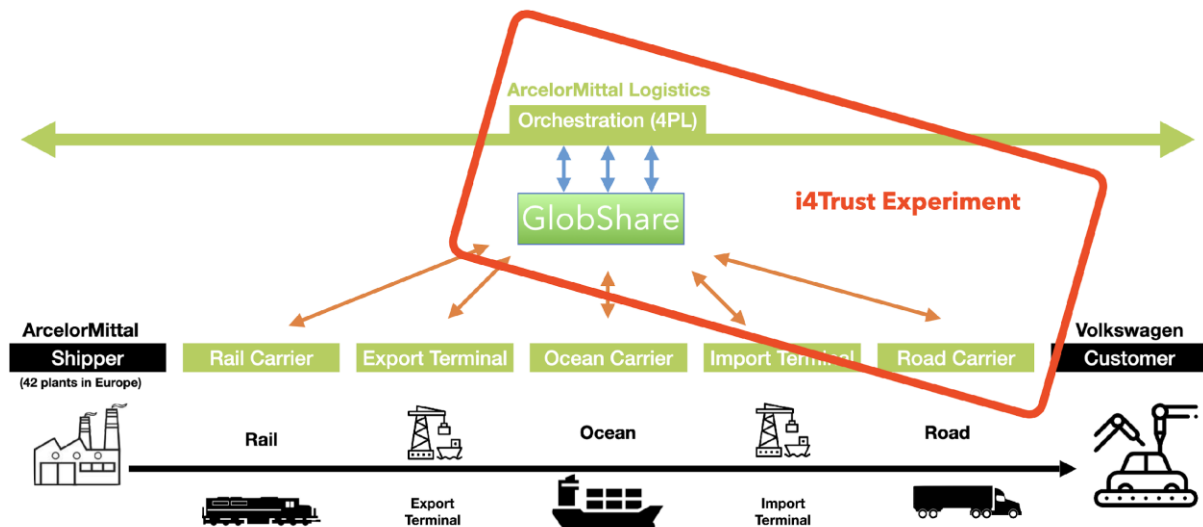
GlobShare turns manual and unstructured communication into efficient and safe data sharing

GlobShare will use FIWARE technology, more specific its context broker capabilities, to rapidly create the specific data models for all Digital Twins involved in the experiment. iShare will be implemented to create secure data sharing rules and manage the identification and authorization processes of the experiment.

The companies that are involved in GlobShare are:

▪ Cabooter Terminals

Rail Terminal in Venlo (Nl) that acts as an intermodal (rail/road) hinterland hub for containers and breakbulk (steel),

▪ Renory Terminals

Inland Waterway Terminal in Liege (BE) that acts as an intermodal (road/barge) hinterland hub for containers and breakbulk (steel)
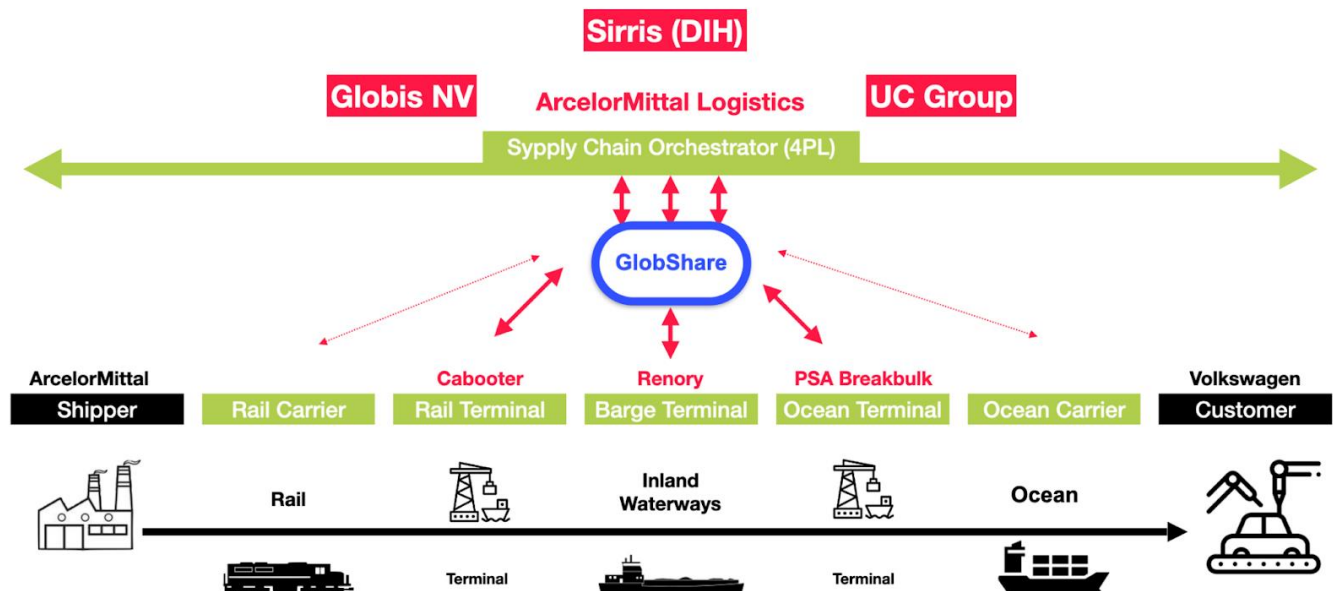
▪ Globis

The software company that is the main participant and contributor to this experiment

▪ UCgroup

The supply chain specialists that co-design the dataspace for the steel supply chain in this experiment
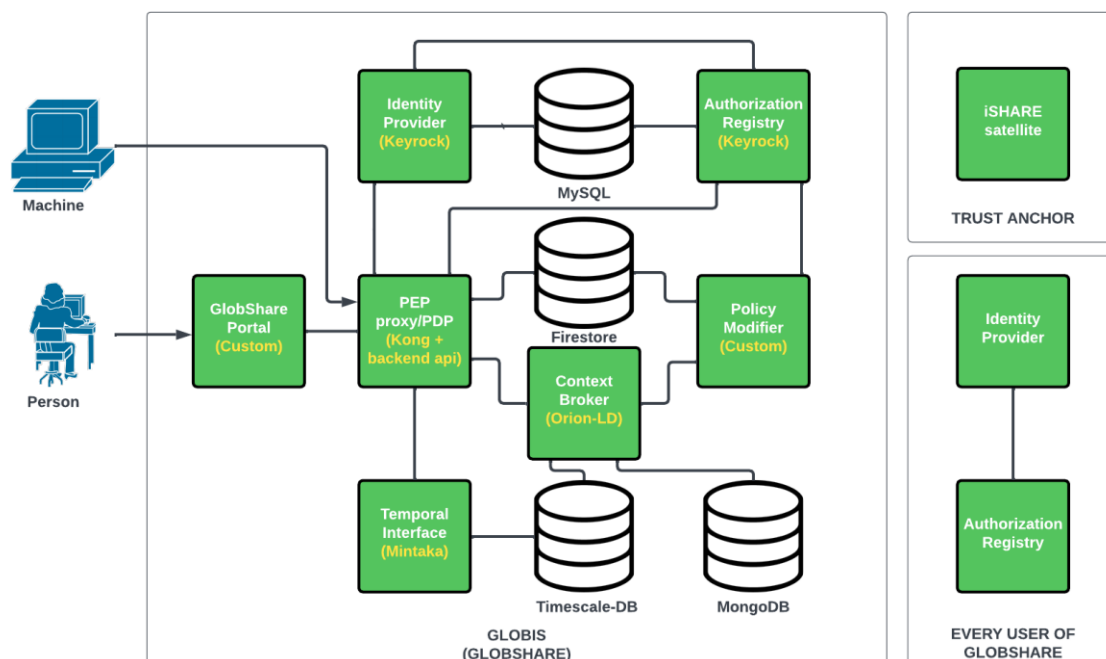
▪ Sirris

The Digital Innovation Hub involved in this experiment

Summary of the participants and their role in the project

How it works

How components of the i4Trust framework are used at a high level

The above high-level architecture includes all participants/roles in the data space. For the current implementation, Globis is a service provider, providing the GlobShare application as explained in this document. All other participants in the experiment are service consumers, consuming the service of Globis. Currently, it is assumed that all participants have deployed a Keyrock component to act as an identity provider (IDP). This enables them to create identities for their employees/people who act on their behalf, enabling them to log in through their IDP. The Keyrock deployments also have their authorization registry (AR) module enabled, such that there can be policies created for these IDP users or other data participants, indicating what access rights they have. For example, the IDP of GlobShare is used by GlobShare admins. Its AR is used to store the access rights of these admins and to store the level 0 authorizations that GlobShare produces via its policy modifier (see further).

GlobShare uses the Orion-LD context broker to store its context data in a MongoDB database. The context data that is stored is supply chain data. Participants in the transactions within this supply chain can then easily look up and modify the data attached to these transactions in a secure and trustable way. Which participants can do what is dynamically chosen by the policy

modifier, based on certain rules (see further). Because Globis is also interested in generating and securing historical context data, the temporal interface of the context broker is also activated. Historical data is accessed through the Mintaka interface, connected to a Timescale-DB which stores the historical context data. Both the Mintaka and default Orion-LD NGSI-LD interfaces are secured using the Kong API Gateway with the ngsi-ishare-policies plugin (acting as a PEP proxy/PDP).

The GlobShare application includes a web portal for employees that need to use GlobShare in the name of their companies, or just an API for other usage (e.g. machine to machine communication). A machine that connects to the GlobShare system can generate its access token via the Keyrock component and supply this with its requests to the Kong PEP proxy. The API can also be accessed through a console application, which is not indicated on the above picture. When employees log into the GlobShare system through the web portal, they need to choose an identity provider to log in. After logging in, the GlobShare application will receive an access token (after supplying the OIDC code) with which it can retrieve information about the employee, and its rights within the company. This information can then be passed to the PEP proxy/PDP when the employee makes a request.

Almost all actions executed on the GlobShare portal (delete/create/update/read entity data) go straight to the API gateway, which uses the normal Keyrock/Orion-LD API. The GlobShare portal however also uses a backend API to dynamically construct its pages (e.g. configuration settings). For example, showing a list of all entities that a user can read is done through this API (see section 12.2). Because of this, an additional Firestore db is deployed which holds all entity IDs that the data space participants can read, per participant (company level, level 0 authorizations). At the time of writing, the backend API for the portal is deployed as a separate module, but should be integrated with Kong in the future.

The iSHARE satellite will act as the trust anchor within the data space. This role will be best fulfilled by an organization that is:

- Neutral to the Data Space participants
- Has experience in governance of business collaborations
- Has technical expertise and understands the concepts and complexities of IAM and Data Sharing
- Has the potential to quickly understand the industry, its transactions and the roles within this industry

At this moment we think of Innopay BV (https://www.innopay.com/en) as the ideal organization to act as an iSHARE satellite. Innopay is the organization that originally developed iSHARE on behalf of the Dutch government and transport industry. Globis has been in contact with Innopay for many years and we consider them to have the best experience and references to act as an iSHARE satellite.

The goal of the GlobShare system is to automatically generate and/or modify existing policies when a company or employee of a participating company modifies data within GlobShare. An important distinction needs to be made between policies:

1. Policies where GlobShare is the issuer. In this situation, GlobShare gives the rights to a company to read/modify data for certain entity types within the GlobShare system. In the current implementation, GlobShare creates all level 0 authorizations and is the top issuer of all the delegations for data within the GlobShare system.

2. Policies where a company is the issuer. In this situation, a company gives (a subset of their) rights to another company or user to read/modify data within the GlobShare system (e.g. subcontract). In this situation, a delegation takes place. This type of policy is currently not created by GlobShare itself (except for managing its own employees who use the GlobShare IDP). Such policies can be created by the service consumers to delegate rights to their employees/people that represent them, or to delegate read access to another data space participant (see section 10.2).

The first type of policies are modified/created by the policy modifier component. This component works by creating subscriptions on the context broker, for incoming data. When data comes in that fulfills one of the subscription conditions, the context broker will send a notification to the policy modifier. The policy modifier can then process that notification, resulting in a policy change or even the creation of new entities. It defines what policies need to be updated or created by reading a configuration file in which the owner of the policy modifier describes the policy rules. These rules are flexible enough to dynamically define new policies at runtime, using values from received notifications or even values from new or referred objects (through values or relationships of values in the notification). When the policy modifier is started, it creates or overwrites the necessary subscriptions based on this configuration. It is also possible to configure the policy modifier to create new entities (and configure access rights

for them) when a certain notification comes in. For the MVP, the policy modifier also supports the creation of notification emails when the context broker notification includes a custom 'email' header.

An example of a flow that changes policies is when a transport issuer changes the status of its transport from "Created" to "Booked". When this happens, the carrier (another data space participant) gets read access for that *Transport* entity and partial update access (it can update the status to the next value).

The current MVP does not yet utilize the Mintaka interface to its fullest. The console application can request historical data of an entity, using the iSHARE rules, but the portal does not yet have this functionality. The internal Keyrock instance has also been modified to allow for full policy retrieval, policy deletion, simplification and merging (admin-only operations). The policy merging operation was necessary to implement the basic use case (see below) because the vanilla policy overwrite operation within Keyrock overwrites the full policy when a policy for a certain issuer and subject already exists.

Benefits & Impact

Until now, we didn't find any one in the breakbulk industry, who argued that smart, easy and safe data sharing of operational events would not benefit tremendously to the industry. This is why the Antwerp break bulk industry had very high hopes for the BulkChain platform, a spin-off of NxtPort that was going to enable such data sharing.

Sadly, after more than 3 years, BulkChain is not able to exchange simple delivery orders, and its added value is -sadly- very low for the industry.

We knew that a more flexible way of data sharing between smaller groups of participants was the way to go. But for Globis, there was no easy or (relatively) cheap way to realize this vision in a practical way.

And this is where i4Trust stepped in. The building components of i4Trust, together with the weekly mentoring calls, offered us a clear pathway to creating a working prototype of a flexible data sharing product, we named 'GlobShare'.

Although we found some limitations in the provided technology, they are relatively easy to overcome, since all components are open source.

We see GlobShare not as a stand-alone product next to Globis' supply chain management suite, but rather as a compelling and integral part of our offering, which expresses a clear vision of horizontal collaboration in the supply chain, whereas most software players are still thinking very vertically and offer tools to solve one particular functional issue within an organisation.

This is why we expect more indirect (positive) effects on our revenue (20%) - after GlobShare is officially launched as a product- than direct effects 10%. But a revenue increase of at least 30% is to be expected as a result of our data sharing product 'GlobShare'.

To make a concrete estimation of direct and indirect revenue, as a result of launching GlobShare, we need to have a look at -what we think of- an actual Data Space

Shipper/Supplier		ArcelorMittal
		Nippon Steel
Customer		Chrysler US
		Volkswagen BR
		Boeing US
		Tesla Berlin
Forwarder		**ArcelorMittal Logistics**
		Haeger & Schmidt
Carrier	Road	Alders Transport
	Road	Ewals Cargo Care
	Rail	Lineas
	Rail	DB Cargo
	Inland Waterways	DGA Shipping
	Inland Waterways	azerty
	Ocean	Fednav
	Ocean	Clipper
Terminal	Ocean	**PSA Breakbulk (BEANR)**
	Ocean	Steinweg (NLRTM)
	Hinterland	**Cabooter Venlo**
	Hinterland	**Renory Liege**

We estimate that an average Data Space in our target industry will consist of about 20 participants. Of which an average participant can be charged for a 500 euro per month basic subscription fee. Since there are certainly net data contributors and others that profit the most from the shared data, this € 500 is merely an average and also based on a total subscription cost of 10k/month that flows towards Globis.

Besides the subscription cost, we expect also to generate a reasonable amount of consulting and integration work, to assist companies in setting-up, integration with current back-office systems. We estimate this as an average of € 5000 one off onboarding cost per participant.

Of course, we expect Globis to deliver multiple data spaces, and it is certainly possible that certain logistics service providers will finally participate in multiple data spaces, profiting from a one-off technical integration with GlobShare.

Besides the steel industry (based on the ArcelorMittal supply chain), we see a huge potential in the Project Cargo Industry, which is common to break bulk, but works on long running projects that involve many logistics parties and subcontractors. Examples of such 'projects' are building windmill farms in the sea, building new chemical plants etc. For the sake of this exercise, we - conservatively- estimate to initiate one new data space per year and for each dataspace to grow from 10 to 40 participants over 4 years.

When companies participate in Data Spaces, they automatically get into contact with Globis. So, Data Spaces give us an increased visibility to companies and we expect a percentage of those companies to become qualified prospects, and finally customers for other Globis modules and services.

A non-binding and simplified projection of the revenue impact of GlobShare-based Data Spaces, can be found in the following table. As a reference point, turnover is expected to hit the app. € 5 mio by the end of 2023.

		2024	2025	2026	2027	2028
Direct Revenue		**110.000**	**280.000**	**510.000**	**800.000**	**930.000**
Data Space 1	Revenue DS1	110.000	170.000	230.000	290.000	240.000
	Participants	10	20	30	40	40
	Subscription (ARR)	60.000	120.000	180.000	240.000	240.000
	Services	50.000	50.000	50.000	50.000	0
Data Space 2			110.000	170.000	230.000	290.000
	Participants		10	20	30	40
Data Space 3				110.000	170.000	230.000
	Participants			10	20	30
Data Space 4					110.000	170.000
	Participants				10	20
Indirect Revenue		**135.000**	**405.000**	**810.000**	**1.350.000**	**1.755.000**
Total Participants		10	30	60	100	130
% Upsell	10%	1	3	6	10	13
Revenue/Upsell	135.000	135.000	405.000	810.000	1.350.000	1.755.000
Total Revenue Growth		**245.000**	**685.000**	**1.320.000**	**2.150.000**	**2.685.000**

Evolution of Revenue Growth based on Data Spaces

Added value through i4Trust

Enabling horizontal collaboration in the supply chain has been part of the Globis vision for many years. Since signing up 3 customers that daily work together in the ArcelorMittal supply chain, we have a chance to bring this vision to reality because we see daily the inefficiencies that result from a lack of data sharing.

i4Trust, its technology components and the Mentoring Program resulted in a clearer view on all aspects to consider. Certainly from a technology point of view, we would not know where to start, if we hadn't participated in this program. The Business Mentoring Program learned us a lot about why and how to include potential business partners, external data providers, leveraging existing communities and many more.

Also, we learned that there will always be net contributors and net consumers of data, and that one party can benefit the most from a Data Space and needs to incentivize its business partners to contribute to the system.

The Business Mentoring Canvas results in a more organized and realistic approach of the go-to-market strategy of GlobShare product. It made us think thoroughly about potential business partners and eco-systems (eg. BulkChain)

We don't expect GlobShare to contribute, immediately and substantially to Globis revenue growth, but our company reputation and visibility will be increased. This will indirectly lead to new customers for the Globis platform as a whole!

As a next step, Globis will spend extra development effort on the current technology/code base, eliminating the most important (remaining) technical bottlenecks of the iShare and Fiware technology.

Then, the experiment will be showcased to ArcelorMittal Logistics, who is already a Globis customer, in order to convince them to use GlobShare as a means of data sharing between them and the many logistics service providers that work for ArcelorMittal.

Next steps

For Globis, the work on Data Spaces is not finished with the end of this project. A number of short and long term actions are already defined.

Short Term Technical Actions:

- Optimise the existing code
- Document the existing code
- Work around some limitation of the provided technology, which might include forking some open source components and adjust them to our needs
- Perform load tests to detect potential bottle necks
- Create documentation on how to set-up and manage a data space
- Make GlobShare more easy to deploy with 'infrastructure-as-code'

Short Term Non-Technical Actions:

- Expand the datamodels to fit the need in a real world situation
- Set-up live connectivity to ERP/TMS/WMS systems of the pilot customers
- Monitor the live use of the system

Long Term Actions:

- Add more Logistics Service Providers, involved in the transportation of break bulk, especially steel, to the system
- Monitor the use, gather user feedback and optimise the platform
- actively participate in Data Space organisations (notably https://www.dataspacesalliance.be and https://internationaldataspaces.org)
- Participate in future, funded Data Space projects (Belgian or European)

Long Term Vision:

With a successful use of GlobShare in the steel industry, we think it is relatively easy to copy the concept to other industries, as long as Globis can join existing ecosystems in that industry, that have access to many potential participants.

We might also consider licensing the technology to other organisations and ecosystems, without Globis needing to become a specialist in every supply chain that can benefit from Data Spaces.
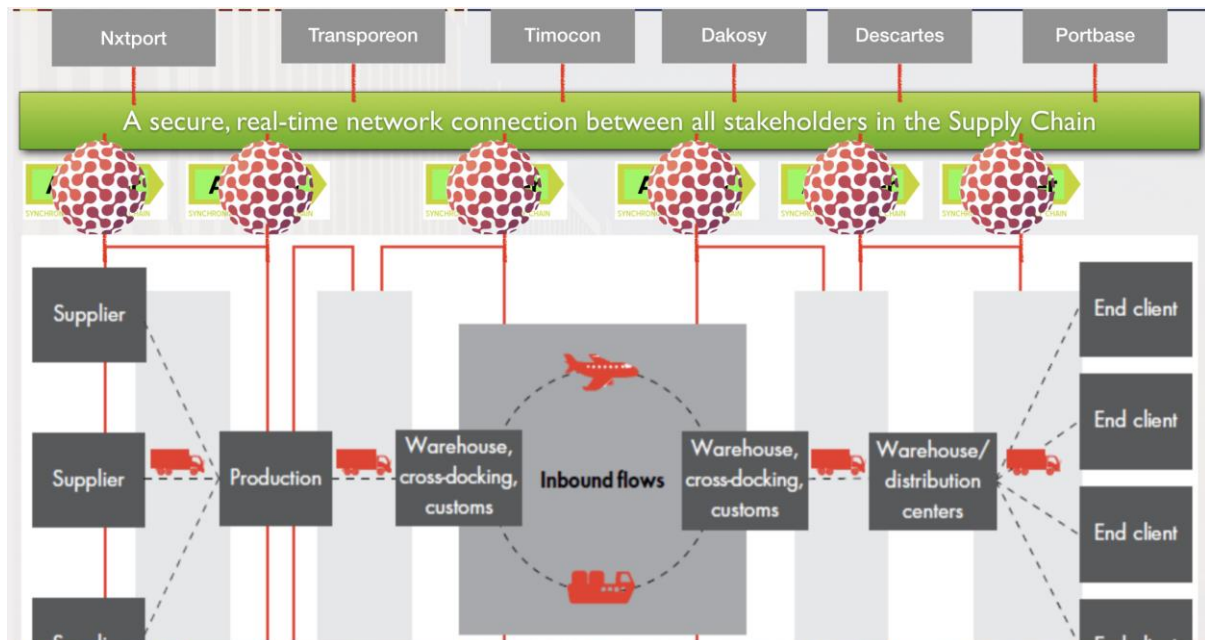
Using iShare and FIWARE technology to establish a secure, real-time network of data providers and consumers in different Supply Chains

References

- https://i4trust.org
- https://www.fiware.org
- https://www.fiware.org/catalogue/
- https://ishare.eu
- https://dev.ishare.eu
- https://ngsi-ld-tutorials.readthedocs.io/en/latest/
- https://internationaldataspaces.org
- https://eherkenning.nl/
- https://www.poort8.nl/
- https://www.iamconnected.eu/
- https://digital-strategy.ec.europa.eu/en/policies/discover-eidas
- https://test-docs.peppol.eu/logistics/

Authors & Contributors

- Jelle Van De Sijpe – Developer - jelle.vandesijpe@globis-software.com
- Karel Van den Berghe – Project Lead – karel.vandenberghe@globis-software.com
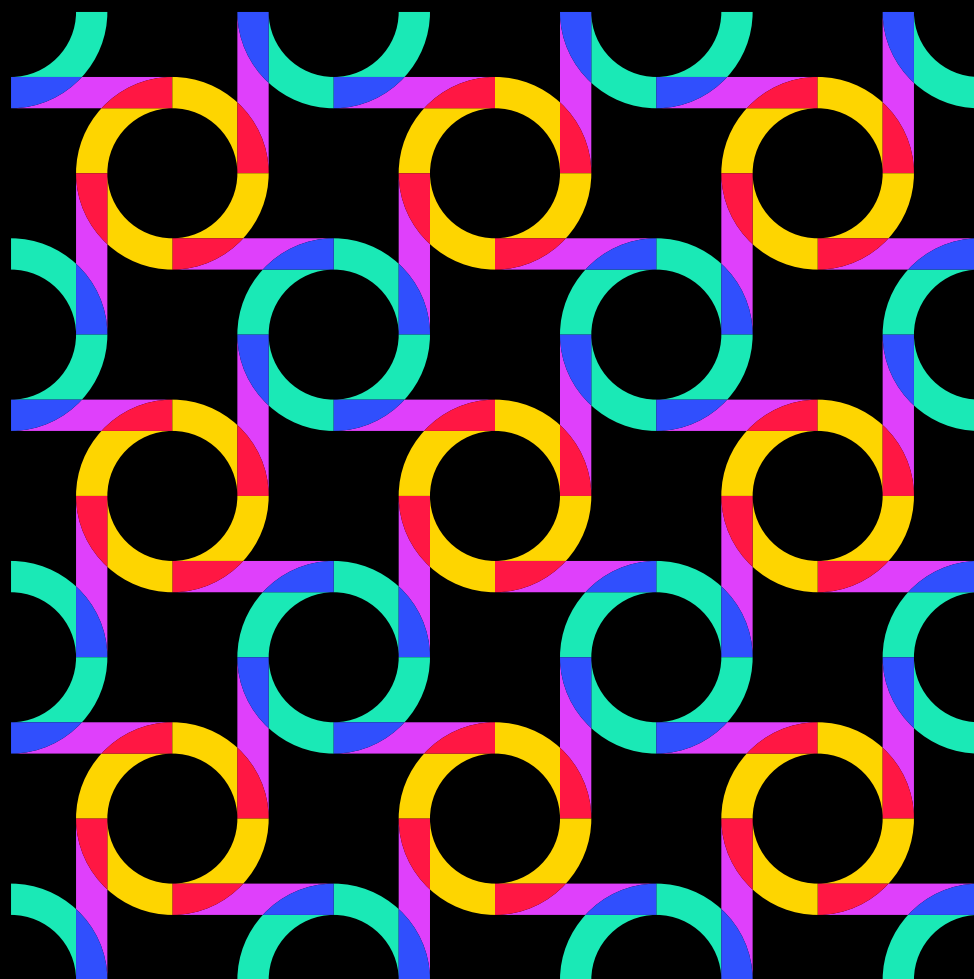
Categories

User(s):

Logistics Service Providers, Break Bulk Forwarders, Break Bulk Carriers, Inter-Modal Terminals, 4PL,

Key words:

Smart Logistics, Digitization of Break Bulk Logistics, Autonomous Supply Chains, Data Sharing, Digital Twins, Inter-modal Transport

Disclaimer: In accordance with our Guidelines concerning the use of endorsements and Impact Stories in advertising, please be aware of the following: Impact Stories appearing on the i4Trust site and partner's site or in other digital or printed materials. It is possible to hand in text, audio or video submissions. They are individual experiences, reflecting real life experiences of those who have used our technology and/or services in some way or another. We do not claim that they are typical results that customers will generally achieve. i4Trust partner's reserves the right to revise the contents, make them shorter and adapt them as required.

GlobShare

Data Spaces for Breakbulk Logistics