Colodas

Experiment in the building materials logistics area to demonstrate Supply Chain 4.0

Smart Cities and Smart Buildings

Colodas: Experiment in the building materials logistics area to demonstrate Supply Chain 4.0

With the contribution of:

- **InnoTractor**

- **Circle Lines Logistics**

- **Fynly**

- **EPS Design**

- **TNO**

- **Context-in-Trust**

Challenge & Context

The main objective of the experiment is to demonstrate a minimum viable product of a Supply Chain 4.0-oriented platform which enables trusted data sharing amongst the key stakeholders of the supply chain at hand.

Why? The business of logistics will change drastically in the coming decade as society drives change towards reduced environmental impact, less waste, higher predictability, clear ownership and accountability, the always present cost reduction based on optimization and more. Digitalisation is a fundamental element of the ability to drive change and is often named Supply Chain 4.0. McKinsey estimates savings of -15% to -80%. Governments demand action to reduce CO_2 emissions and by digitising the supply chain there is more control and data to drive policy making and enforcement. The DiLLaS platform is the fundament of the Internet-of-Cargo digital infrastructure which will make Supply Chain 4.0 a reality in the Netherlands. This is supported strongly by a group of companies and governments. The Colodas initiative will provide an improved data sharing element to the DiLLaS platform by InnoTractor which will be offered as a SaaS service to participants based on a fee per transaction on top of a base fee.

Even though parts of the logistics flow are digitised today, there is no overarching platform that enables true Supply Chain 4.0 and tracking of key environmental data like CO_2 emissions in an end-to-end fashion. Often one or more elements are missing, or the chain is not connected: no exact tracking of goods, no control over the condition of the goods, handovers between parties are not digitised and there is no tracking of the CO_2 footprint/modality used of the transport. By digitalising this logistics flow a substantial amount of data is created. This data should be trusted by all parties in the chain and needs to be shared between authorised parties. Therefore, in the Colodas project, we are focused on a transport-item as an indivisible "unit" of goods in the logistics chain. A digital twin of this transport-item is used as the central element in the Colodas project. This digital twin of the logistics chain is highly valuable to stakeholders but is complex to realise. During the experiment development the need for a digitalized twin of the real world in the building materials logistics area has become even more important as the pressure by the government in

the Netherlands to build more houses and at the same time reduce the impact on the environment has increased.

Solution

The Colodas experiment can be described by the following elements:
● An IoT (internet-of-things) device which will be provided by InnoTractor and works on the mobile network will be placed onto flat rack containers which will carry bricks (or similar transport);
● The IoT devices will track the location of the flat racks during transport from the bricks factory to the end customer;
● Flat racks will be provided to one or more brick factories so they can load the bricks on the flat rack;

The process that the experiment will realise is structured as follows:
  ● The brick factory which will be chosen by Circle Lines Logistics and SCS Multiport as part of the demonstration and as the starting point the logistics chain will use a web application provided by InnoTractor which will start the logistics tracking process.
  ● The IoT device, provided by InnoTractor, which will measure location is registered in the distributed ledger DiLLaS. A shipment is then created. The factory will also set the modality used for the next leg of transport;
  ● A transporter (truck or tugboat) will collect the flat rack. At the handover, the truck driver/tugboat captain will use a web app for the handover process;
  ● The factory and transporter will do a handover with the app whereby the responsibility for the goods is handed over and registered as an event;
  ● The goods are transported to the next location. The IoT device will keep measuring location;
  ● Upon arrival at the next destination where a handover takes place the receiving party will accept the shipment;
  ● This process is continued until the shipment has reached its final destination;
  ● At any point in time the data generated can be seen by authorised parties through a web-based interface which shows; selective data like for example shipment, IoT device, location, modality, owner/responsible, time/date stamps;

- Based on this data the journey data of a shipment with location and modality can be shared such that it can be translated into a CO_2 report based on estimated CO_2 impact data.

With this data, the goods in transit can be followed in the digital twin which provides the insights which form a key part of the Supply Chain 4.0 future.

How it works

The solution, which is built in the Colodas experiment, consists of several elements that are both in the physical world as well as in the digital world.

We track and trace our shipments in the physical world via our IoT (internet-of-things) solution by means of the Orbitz tracker as provided by InnoTractor in the field. Thissends regular updates over the mobile network (using GSM, Cat-M and/or NB-IOT) in a customer-specified interval (likely 15 minutes) to the InnoTractor BV "Handover API" (DiLLaS) and stores the GPS location data and handover information from the logistical stakeholders there. This can be done using a mobile app provided in the Colodas platform. The data is then pulled from the InnoTractor Handover API and stored in the FIWARE Data Space endpoint (Orion-based). This data is only available to people from the identity eco system "iSHARE" based on the ABAC profile specified in the API Gateway (pushed from the iSHARE Keyrock provider). An iSHARE entity can access the data in Fiware or not. All systems are running within a zero-trust environment, this is achieved by using closed IDM-based flow and is hosted in Azure. The primary technology used on the infrastructural level is container-based (Docker/K8S) and fully capable of running in splendid isolation without any other infrastructure except K8S/Docker hosts. This means our solution can be started in any cloud provider that adheres to our requirements in regards to compliancy, security, and other factors.

All traffic between the services is fully encrypted in transit but also at rest, and by using the Microsoft Azure ecosystem and implementing the highest recommended practices with regards to data management and security we are compliant on the

highest level. The APIs are hardened in production for mitigating and reducing security risks.
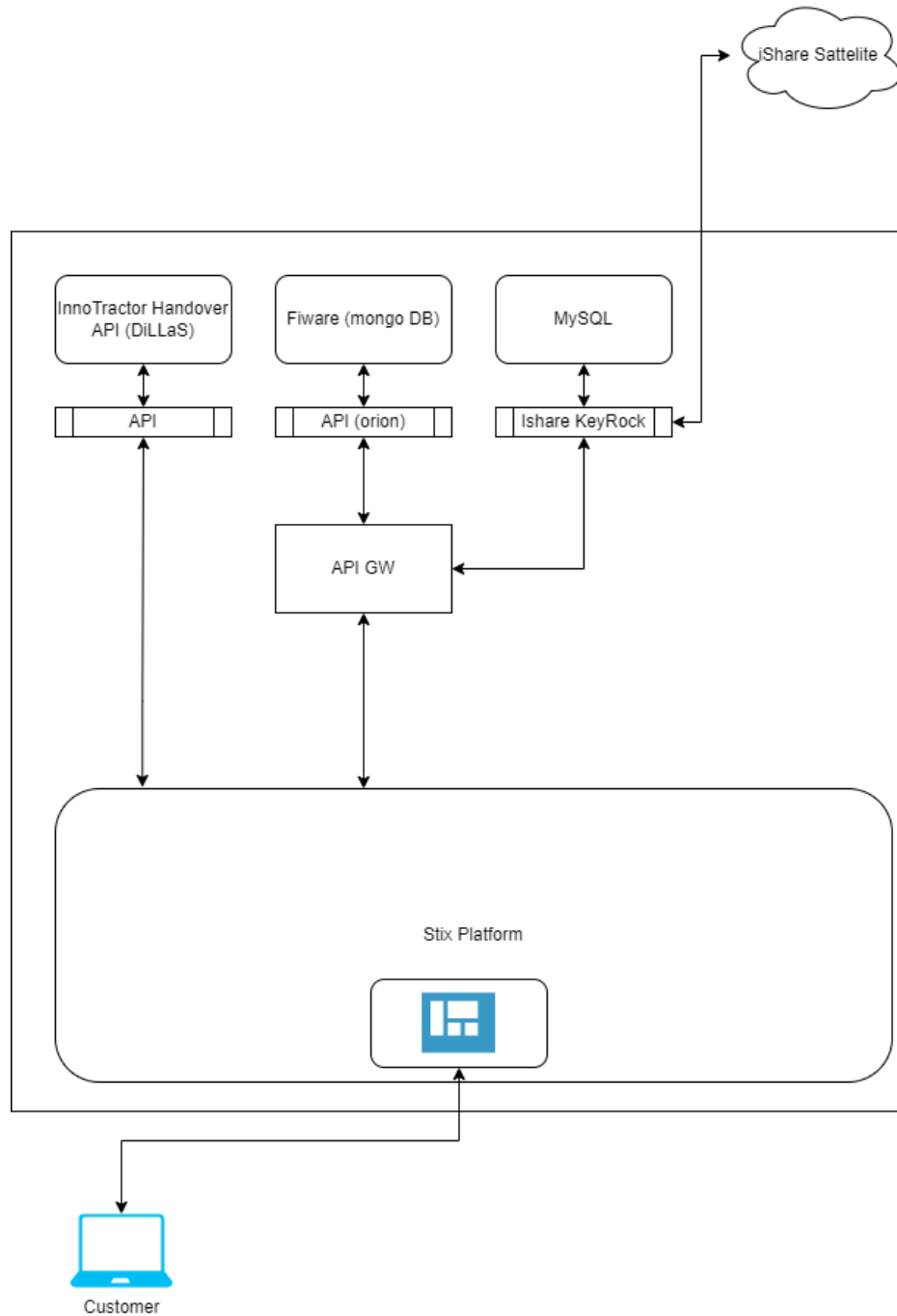
Benefits & Impact

The Colodas experiment is initially targeted toward the building materials logistics world. In the Netherlands, there is the challenge to build one million houses in the coming years. There are hundreds of companies and organisations involved in logistics around this huge challenge. If they will all use Colodas and the solution to build upon Colodas as a base then there will be over ten thousandusers from dozens of companies. However, Colodas will require the adoption of an ecosystem and this will take time.

The clients of Colodas will be a group of companies and governmental organisations. The companies will consist of manufacturers, transport companies, warehousing companies, hubs, builders and end customers. Governmental organisations will be local, regional and national governments which will use the data stored in the FIWARE dataspace, especially around the transport data and the CO_2 emissions data which can be derived from it.

As described in the sustainability plan, we see many opportunities to expand the service. We see that it will be possible to expand it by adding more services as features as well as using the service in other verticals which have very similar challenges. The feature growth can be found in services like micro-payments and micro-insurances which are triggered by events in the logistics flow. The expansion of the verticals can be any other logistics flow than the building materials one, such as food logistics for example.

The Colodas solution aims at the implementation of a true Supply Chain 4.0 solution in the long run. According to McKinsey, this has the potential of savings of up to 75% compared to Supply Chain 2.0. Besides these savings, the grip on the logistics process will enable a few key contributions to the sustainability of our environment. With the logistics grip over logistics flow from several manufacturers towards a construction site, you can enable the hubs that need to be set up outside of cities so that the transport to inner cities can be pooled to reduce traffic. The experiment will also enable CO_2 tracking so that there is more insight into how goods are transported which stimulates the use of waterways-based transport or other "cleaner means" of transport.

As the solution is new, the insight into the expected growth of revenue of the involved SMEs is very difficult to predict. However, given the feedback received from

stakeholders in the field, this can, in the coming years, lead to growth up to and beyond 100% of current revenues of primarily the participants InnoTractor and Circle Lines Logistics.

Added value through i4Trust

The idea to combine FIWARE and iSHARE benefits into the i4Trust initiative has been a very good one and will without a doubt lead to a number of real-world experiments which create data spaces that are very much needed for the challenges ahead. For Colodas and the Colodas partners, the experiment has been a steep learning curve but we are confident that the outcome brings a solid foundation upon which services can be built and business can be developed which truly makes a contribution to efficiency as well as a more sustainable world.

The i4Trust Colodas experiment has provided many learning points for the participants. Over time, the technical solution has been adjusted several times as the different parts which were planned have been adjusted to the architecture of existing solutions. Over time, the engagement with the representatives of iSHARE and FIWARE in the weekly mentoring program has provided insights and support which has brought us to the stage where we are at now. The knowledge of iSHARE and FIWARE gained will be re-used in not just the Colodas project and its succeeding business development but also in other projects in which the participants as well as the members of these participants will engage in the future.

i4Trust is spot-on in terms of providing a standardized solution for what is needed in the world in terms of sharing data in an advanced way. The benefits of iSHARE, providing a framework for identification, authentication and authorization, are essential to facilitate data sharing in an open space with many participants. FIWARE enables the data spaces to share data, again essential to the open but secure world of sharing data.

The FIWARE Global Summitummit in Gran Canaria has provided a good opportunity for technical discussions and networking. In business engagements that the Colodas

partners have been part of during the experiment period the i4Trust experiment and the benefits of iSHARE and FIWARE have been shared and are appreciated. With the recent news of the relation between iSHARE and Gaia-X the interest has only increased.

Next steps

The experiment will be used as a demonstration to several stakeholders. These include governments (a list of regional and local governments which the Circle Lines Logistics and Fynly members have been in close contact with for the past 2 years), companies (especially in the building materials logistics space, manufacturers), organisations (like DigiGO, an organisation which has as a mission to promote the digital collaboration in the built environment and its standardization body DSGO) and even wider. With the municipalities and a set of companies from the construction business, there are already discussions on a next experiment that builds upon Colodas.

A main player in the group of stakeholders, which will determine the future of logistics in the construction business, is "[Topsectorlogistiek](#)". We have engaged with this organization,which reports directly to the Ministry of Economic Affairs. Its prime focus areas are data-driven business, sustainability and logistics chain coordination. All of these organisations mentioned are directly connected to the goal of Colodas and we are working out how we can cooperate with this organization for the future. So far the response has been very encouraging.

We will post the video on online channels as a reference for the experiment but also as a teaser for the next steps we want to make with the value created in the Colodas experiment.

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