1. Background

President Juncker has identified Jobs, Growth and Investment and A Digital Single Market as the main priorities for EU policy over the coming years. The goal is to foster growth, competitiveness, jobs and the development of the internal market by making better use of the opportunities created by digital technologies. In order to take the digital agenda for transport further, the European Commission launched the Digital Transport and Logistics Forum (DTLF). The DTLF brings together stakeholders from transport and logistics industries to identify areas where common action is needed, to provide recommendations in particular addressing e-transport documents, working towards the optimisation of cargo flows through better use and exchange of data and standards for seamless data exchange.

In the absence of a common framework, architecture, business model and governance structure for connecting corridors across-borders using existing IT systems and services an ambitious project kicked off under the EC Horizon 2020 programme. AEOLIX was launched in September 2016 with the aim of contributing to the priorities of the EU policy, but also the optimisation of cargo flows, the facilitation of supply chain management, the reduction of administrative burdens and to make better use of existing resources.

2. AEOLIX Objectives

- Gain a thorough insight in the lessons learned, needs and requirements in the domain of ICT applications for logistics
- Design an architecture for a collaborative IT infrastructure for operational connection of logistics information systems
- Implement an appropriate data access management model
- Build a common but user-tailored interface and tools to enable the IT infrastructure
- Test, validate and implement the AEOLIX prototype in 11 living labs of logistics business communities across Europe
- Monitor the impacts of AEOLIX based on environmental, economic and social impacts
- Develop an exploitation business model to enable roll-out and deployment of the concept across Europe, and possibly rest of the world

The AEOLIX Platform represents a critical step forward for supply chain visibility and interoperability through the decentralisation of information sharing. AEOLIX cloud services provide connectivity between multi-actor data and in-house or cloud-based applications, processes and services, resulting in enhanced collaboration and interoperability, potentially across the entire transport and logistics sector.

3. AEOLIX Technology

Supply chain efficiency largely depends upon data and information – how it is collected, processed, stored, updated, interpreted, understood, and exploited. On an operational level, actors need actionable information, sometimes in real-time, to be able to make effective decisions. On the tactical and strategical levels, the transportation system needs increased connectivity. In previous projects and ventures, much focus has been placed on creating methods of data sharing which are both centralised and standardised. The logic behind this design approach is simple: if all actors are using data the same way (classification, semantics, format etc.), many of the challenges regarding interoperability are overcome. In reality, however, these projects are likely not to succeed, often due to individual organisations that are unwilling or unable to conform to standards that do not improve their internal efficiency, or to place data under the influence of a third party. A decentralised approach, however, has its own complexity and its own challenges. By allowing individual actors to decide how information is shared, a large number of bilateral agreements become necessary and the number of prospective interfaces to maintain increases geometrically with the number of actors in a system.

AEOLIX will develop a platform for connecting logistics information systems of different characteristics, intra- and cross-company, for immediate (real-time) exchange of information in support of logistics-related decisions. The ambition is to develop architecture for a distributed open system which will exchange information among key logistics actors (commercial companies as well as relevant authorities), enabling increased use and impact of such information in the value chain. During the project, logistics related business issues have been selected as use cases to be researched at different Living Labs to validate and demonstrate the benefits of the platform.
AEOLIX provides a comprehensive architecture for a digitally secure and regulated logistics services and information sharing platform, based on the following specific components:

**AEOLIX Dashboard:** is an intelligent, user configurable web application which serves as a dedicated portal to the AEOLIX Platform. It manages and enables access to end-to-end logistics visibility by sharing data of the logistics partners via the Connectivity Engine (CE). It enables intelligence to be added to the data from within the dashboard and by accessing and mobilising applications from the toolkit.

**AEOLIX Toolkit:** comprises core logistics services to support and implement the business needs of AEOLIX end-users. Examples of services to be offered in the toolkit are: e-CMR, ETA, Planning, CO2 footprint, Port services... Toolkit services can be used via the AEOLIX connectivity engine by applications, services and sensors or interplay with other toolkit elements.

**AEOLIX Connectivity Engine:** is responsible for providing the connectivity and interoperability services supporting seamless data exchanges between organisations and services. These technical services provide the architectural setup: (1) connecting the end-user with its many business partners and systems in their networks; (2) allows for interoperability and governance services; the information exchange between different systems; partner/system interactions and data sharing management rules.

The AEOLIX Platform support services will provide not only an additional tool through the dashboard but a set of integration tools such as APIs (Application Programming Interfaces) and SDKs (Service Development Kits) to allow the integration of existing end-user systems or services and the possibility for development of new end-user applications.

In this sense, the AEOLIX Platform provides SDKs (Service Development Kits) to develop or integrate software solutions or services for the AEOLIX Toolkit, enriching AEOLIX Platform services to help logistics stakeholders address the business needs of their processes or requesting specific cloud services. Finally, AEOLIX provides APIs to enable the connectivity of services, apps or devices running in different platforms (Java, .NET, JS...) to the AEOLIX Community Ecosystem in simplified technology integration. The AEOLIX platform provides a security framework based on a trusted model for cloud-oriented collaborative networks and security mechanisms (identity management, authentication/authorisation mechanisms). It is aligned with EU directives and recommendations such as the e-Identification and trust services described in the Digital Agenda for Europe and aligned with the Digital Single Market.

The AEOLIX Platform will have three releases. The platform release 0 was the launch of the project (and not the platform itself) and targeted the whole supply chain community. The subsequent platform releases of the AEOLIX project will initiate different engagement strategies for different types of stakeholders.

The AEOLIX consortium partners will organise the first Platform Release 1.0 as a test fest event in September 2017 (in terms of connection) for shippers, LSPs and service providers to check the initial requirements for connecting different proprietary systems through APIs and to demonstrate the quick wins. The first Platform Release 1.0 will include the development of the main functionalities of the AEOLIX platform (connectivity engine, dashboard, and toolkit). This first platform release will allow the basic data feeds to be visible in the dashboard and also show through the toolkit and APIs how the service providers can be connected.

The platform release 2.0 will involve the intelligence of the connectivity engine to provide added value through the toolkit services and dashboard benefits to each stakeholder. The last Platform Release 3.0 will showcase the final product of interest to the end users. It will also be possible to demonstrate the feasibility of the AEOLIX platform as a self-service platform demo within the AEOLIX website and also to organise webinars as training/capacity building tools accompanied with appropriate training material on how to connect and use it for specific target groups. Information days, high level meetings, conferences and other communication tools will also be used for engaging stakeholders as already planned in the first year. Each release will be validated by users and their feedback will be collected to form requirements for the next release and these will be done in the test fests events. The AEOLIX Community will play an important role in the development by giving their requirements on the Platform. Therefore, the Community building has a natural relationship with development of the AEOLIX Platform.
5. AEOLIX Community Ecosystem

The AEOLIX Community Ecosystem includes all stakeholders involved directly or indirectly:

- **End Users**, including logistics service providers (all modes), shippers, retailers, terminal operators, ports, forwarders, and other logistics businesses, that use the information and services delivered by AEOLIX for supply chain end-to-end visibility, exception handling and event management.

- **Public Authorities** at the local, national and European level, who provide rules and information, including infrastructure managers – for all relevant modes of transport.

- **Service Providers and Developers**, who provide content and services to businesses, public operating agencies and logistics users, or who use the platform functionality (e.g. component APIs) to develop a service which can be offered to customers, either Business-to-Business or Business-to-Consumer.

- **Service Enablers**, who provide vital services, such as telecommunications, telematics connectivity and financial disbursements, to service providers, technology suppliers.

- **Technology Suppliers**, who provide on-board systems and mobile devices that, are used to deliver the end user services.

AEOLIX User Community represents those data owners and data users who are going to “own and use” AEOLIX dashboards and toolkit of AEOLIX. AEOLIX Business Community represents stakeholders from industry and authorities; actively supply to the technical foundation of the dashboard and toolkit. This platform will contribute to establishment, validation and exploitation of AEOLIX.

6. Joining the AEOLIX platform?

An AEOLIX user with its own systems can integrate and connect them directly to the platform using the SDKs, allowing them to connect to the Connectivity Engine (CE) to share information with AEOLIX participants and interplay with services available in the Toolkit to cover their business needs (e.g. using ETA service). AEOLIX users are logistic service providers such as: infrastructure managers (road operators, railway operators...) who can provide their data feeds through National Access points to the AEOLIX connectivity engine platform using the SDKs; Port and Terminal operators using the platform can interact with external actors sharing data using the SDKs or to offer specific operator services through the Toolkit.

A relatively advanced shipper, forwarder or transport company can develop a specific connection to the CE using the SDKs, to receive and send data to the CE and then to the Dashboard for use. For instance, a major shipper in the AEOLIX Consortium seeks to send production volumes and availability to the CE and the Dashboard will make these critical data visible to its transportation partners.

Application providers can provide their services through the Toolkit; users can access the Toolkit via the Dashboard, send data into the application and receive the enhanced data back to populate the Dashboard with the desired information. In one Living Lab scenario, the shipper wants to send GPS truck location coordinates to an app that sends back a map of the truck location into the Dashboard for viewing.

Formal documents (such as customs documents) to port authorities can be accommodated variously: if ports want to offer their services they can use the SDKs and the guidelines for services providers to include their services in the toolkit. If they are not interested in offering any service, but they need to interact with the AEOLIX community, they can be part of the platform and share data or use services within the AEOLIX community.

3rd party applications can be developed on top of the platform thanks to the use of the SDKs, allowing new apps and systems to connect once to the platform and to access the connectivity and toolkit capabilities for addressing specific users’ needs.

A relatively less developed user can upload files that are then received by the Dashboard, and the data in the file is then accessible in the Dashboard; the Dashboard can display the data in a manner agreed between the players, and can be securely accessed from a PC, tablet or smartphone (e.g. using credentials).
7. AEOLIX benefits & impacts

The AEOLIX platform should be a proof-of-concept at the end of the project, demonstrating the feasibility and functionality of features that support new ways of enhancing supply chain visibility and interoperability by implementing and delivering services. It is clear that an impact assessment cannot be easily realised for a platform and services that are being validated, and at a prototype stage or before larger scale exploitation requires a commercial state product and operation. First, it would be possible to analyse previous studies and project the potential (indirect) impact of the selected services and then how, through the platform, these can be enhanced. The overall impact of AEOLIX will depend on the set of future services provided by the platform and the penetration rate of the services. These services will change over the years. The capabilities of a platform such as AEOLIX can potentially enhance the impacts of different services and data. Once the platform is commercially operational, the following benefits will be available:

- Scaling services – services for everyone, everywhere: when a platform enables the same service to be delivered to users independent of their platforms, devices or location, the benefits realised by one user or by the user in a specific area can scale to serve anyone, anywhere with applicable equipment.
- Aggregating services – better services: a platform that makes it easier to incorporate other services can encourage the development of services that include more beneficial aspects. For example, possibility to report traffic incidents could be implemented easily by third party APIs similar to social media functionalities in applications.
- Service and data visibility – reaching end users: easy access to services and information that are available based on user or context may help introduce services to the end user that would otherwise not be found or even looked for.
- Technology interoperability – more services: when solutions can be developed independent of the underlying technology, not only services, but also the technology becomes more versatile in terms of how it can be used by different services.

By examining on a component level the considered functionalities that a platform like AEOLIX could provide to enhance the different services, the different role and purpose of each component in the value chain of the services varies significantly. Components that are used more as user interfaces (e.g. Dashboard) are most relevant for improving supply chain visibility and interoperability in a distributed manner. The Service Development Kit, on the other hand, is a supporting functionality that is crucial in order to use the platform (e.g. creating Service Descriptions), but the actual impacts are realised through other means (e.g. through aggregating services by accessing those Service Descriptions through the Service Directory). The impact of AEOLIX is strongly dependent on the availability and accessibility of the services to a large number of users. Making the platform as user-friendly as possible is essential for increasing the number of users and critical for paying customers. The views of the service working groups were mapped into the four means of generating the impact.

The project will also use the GLEC (Global Logistics Emissions Council) Framework for Logistics Emissions Methodologies already developed by the GLEC, a voluntary partnership of companies, industry associations and green freight programs that is led by Smart Freight Centre and released in version 1.0 in June 2016. The LEARN (Logistics Emissions Accounting and Reduction Network) project builds on and seeks to improve the ‘GLEC Framework for Logistics Emissions Methodologies’ that combines existing methods and fills gaps, making carbon accounting work for industry. The main role of LEARN is to create networks around the GLEC Framework as the universal starting point for logistics emissions calculation and reporting, and to communicate this through those networks to a wider audience. LEARN also plays a role in providing a selection of test beds for the early stage implementation of the GLEC Framework and through AEOLIX this will be ensured in selected living labs.

8. AEOLIX Business and Governance models

As AEOLIX is a platform, it is not just a technology but a holistic business model that creates value by bringing together consumers and producers. Opposed to the dominant business models since the industrial era, AEOLIX will be governed by a platform business model (PBM). Rather than owning production and inventory like most traditional businesses, a PBM creates value by facilitating exchanges between two or more users, allowing users to both produce and consume information. The value proposition of AEOLIX is a combination of technology and the content that the users will create on top of it. AEOLIX value will lie both in its ability to host and stream user-defined content (e.g. data, services or both), and visualize it in a customized way via its dashboard. AEOLIX will set up the basis for an engagement after the project life to ensure the continuation of the collaboration of the stakeholders within the innovation platform.

The AEOLIX consortium is initiating the process of the “AEOLIX Not-for-profit legal entity” which would be responsible for the overall operation of a data and service centric platform for Europe-wide logistics services. This is in order to distinguish it from the current AEOLIX development and research activity. The makeup of this community would be similar in make-up to the Members of the AEOLIX Project, which comprises different types of supply chain stakeholders. The after project AEOLIX technical framework will consist of the technical platform and any functionality provided by the AEOLIX project (Dashboard, connectivity engine, SDK, etc.). Above all, the AEOLIX Legal Entity can play a key role in the market development process.
The objective is to achieve a multimodal, end to end, real time visibility for maritime container flows and to re-align sea- & air-freight-oriented supply chain operations, as well as to increase hub competitiveness, efficiency and reduce emissions and congestion in Hamburg and Frankfurt metropolitan areas.

The aim is to pre-advice and schedule inbound movements to the terminal, synchronizing terminal operations where trailers arrive, are being unloaded and goods are sorted (in addition to new trailers being loaded and shipped), as well as to integrate customs processing and claims management into the supply chain to enable enhanced scheduling decision making and reduce transit time in critical terminals.

This living lab aims at streamlining of inbound flows of goods from multiple FMCG production locations to a large retailer warehousing location to reduce costs and enable modal shift.

The objective is to enhance the compatibility and interoperability of logistics information flow standards and technologies adopted by different regions, and to identify the potential role of ICT in improving co-modality and inter-modality of international logistics.

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The ambition is to manage the transport supply for serving the demand and to improve the visibility for modal services to support the choice of intermodal solutions. This LL also aims to create critical masses for strengthening sustainability of modal and intermodal solutions through load factor increase and rail capacity availability and to improve the efficiency of the Thessaloniki hub by developing a Virtual Freight Centre.

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The aim is to create end to end visibility through AEOLIX on loading and unloading quantity (actual vs forecast quantity) and waiting time including track & trace.
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