

Deliverable D500.4.3

Activities and results of the validation with other standardisation organisations and relevant networks

WP 500

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The Flspace Project

Leveraging on outcomes of two complementary Phase 1 use case projects (Flnest & SmartAgriFood), aim of Flspace is to pioneer towards fundamental changes on how collaborative business networks will work in future. Flspace will develop a multi-domain Business Collaboration Space (short: Flspace) that employs FI technologies for enabling seamless collaboration in open, cross-organizational business networks, establish eight working Experimentation Sites in Europe where Pilot Applications are tested in Early Trials for Agri-Food, Transport & Logistics and prepare for industrial uptake by engaging with actors & associations from relevant industry sectors and IT industry.

Project Summary

As a use case project in Phase 2 of the FI PPP, Flspace aims at developing and validating novel Future-Internet-enabled solutions to address the pressing challenges arising in collaborative business networks, focussing on use cases from the Agri-Food, Transport and Logistics industries. Flspace will focus on exploiting, incorporating and validating the Generic Enablers provided by the FI PPP Core Platform with the aim of realising an extensible collaboration service for business networks together with a set of innovative test applications that allow for radical improvements in how networked businesses can work in the future. Those solutions will be demonstrated and tested through early trials on experimentation sites across Europe. The project results will be open to the FI PPP program and the general public, and the pro-active engagement of larger user communities and external solution providers will foster innovation and industrial uptake planned for Phase 3 of the FI PPP.

Project Consortium

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Document Summary

This document summarises the activities and results of the validation with external standardisation organisations and relevant networks carried out under Sub-Task 541 "Investigation on technology standards for cross sectorial system and data integration" and Sub-Task 542 "Recommendations, collaboration and dissemination". The support of standards in the near final version of the Flspace platform has been evaluated along with the requirements for support of standards from each of the Open Call applications. In addition, requirements for support of standards have been collected from a substantial number of Phase III Accelerator project application developers that intend to utilise the Flspace framework supported by funding from the Flinish, SpeedUP! Europe and SmartAgriFood projects. The support for standards by the Flspace platform and the requirements for standardisation from the Open Call and Phase III Accelerator application developers have been evaluated to validate the Flspace platform support of standards from external organisations and relevant networks. Based on these evaluations recommendations have been identified for future revisions of the Flspace platform as it transitions towards commercial deployment.

Abbreviations

AES	Advanced Encryption Standard	GLN	Global Location Number
AJAX	Asynchronous JavaScript and XML	GPC	Global Product Classification
ANSI	American National Standards Institute	GRIB	General Regularly-distributed Information in Binary form[
API	Application Programming Interface	GTIN	Global Trade Item Number
App	Software Application	HDF	Hierarchical Data Format
B2B	Business to Business	HTML	HyperText Markup Language
BPEL	Business Process Execution Language	HTTP	Hypertext Transfer Protocol
BPMN	Business Process Modelling Notation	i.e.	id est = that is
BSI	British Standards Institute	ICT	Information and Communication Technology
CEN	European Committee for Standardization	IEC	International Electrotechnical Commission
CENELEC	European Committee for Electrotechnical Standardization	IETF	Internet Engineering Task Force
CORBA	Common Object Request Broker Architecture	IP	Intellectual Property
CSB	Cloud Service Bus	IPR	Intellectual Property Rights
CSS	Cascading Style Sheet	ISO	International Standards Organisation
D	Project Deliverable	ITU	International Telecommunication Union
DES	Data Encryption Standard	JAXB	Java Architecture for XML Binding
DIN	Deutsches Institut für Normung	JAX-RS	Java API for RESTful Web Services
DOM	Document Object Model	JCP	Java Community Process
DoW	Description of Work	JSON	JavaScript Object Notation
e.g.	Exempli gratia = for example	KPI	Key Performance Indicator
EAN-13	GS1 Barcode for encoding a 13 digit GTIN	LDAP	Lightweight Directory Access Protocol
EC	European Commission	LGTIN	GTIN with Lot/Batch Number
EPCIS	Electronic Product Code Information Services	M	Project Month
ETSI	European Telecommunications Standards Institute	MVVM	Model View ViewModel
EU	European Union	NGSI	Next Generation Services Interface
FI PPP	Future Internet Public Private Partnership	OGC	Open Geospatial Consortium
FIA	Future Internet Assembly	OMG	Object Management Group
FP7	Framework Programme 7	OSGB	Ordinance Survey Great Britain
GA	Grant Agreement	QR	Quick Response Code
GDSN	Global Data Synchronisation Network	RDF	Resource Description Framework
		RTD	Research and Technological Development

SAML	Security Assertion Markup Language	UPC	GS1 Barcode for commonly encoding a 12 digit GTIN
SCIM	System for Cross-domain Identity Management	URL	Uniform resource locator
SCIP	Secure Communications Interoperability Protocol	UTM	Universal Transverse Mercator
SDI	System and Data Integration	VDN	Vereniging van Bloemenveilings in Nederland (Dutch), Dutch Flower Auctions Association
SDK	Software Development Kit	W3C	World Wide Web Consortium
SGLN	Serialised GLN	WFS	Web Feature Service
SGTIN	Serialised GTIN	WMS	Web Map Service
SME	Small and Medium Sized Enterprise	WP	Work Package
SOAP	Simple Object Access Protocol	WSDL	Web Services Description Language
SOS	Sensor Observation Service	XACML	eXtensible Access Control Markup Language
SQL	Structured Query Language	XML	Extensible Markup Language
SSCC	Serial Shipping Container Code	XPDL	XML Process Definition Language
ST	Sub-Task	XSD	XML Schema Definition
T	Task		
TLS	Transport Layer Security		
UML	Unified Modelling Language		

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1 Introduction

1.1 Purpose and content

This document represents deliverable D500.4.3 “Activities and results of the validation with other standardisation organisations and relevant networks”, and focuses on validating the support for standards within the Flspace platform for standards published by standards organisations and relevant networks who are outside of the project consortium. Support for specific standards is evaluated and any gaps that could reduce the market impact of the Flspace platform in addressing not only the originally targeted sectors of Smart Agrifoods and Transport & Logistics, but also other related segments being targeted by the Phase III Accelerator project applications are identified. The document is one of three deliverables describing the outcome of Task 540: “Standardization”, which aims to ensure standards are used throughout the Flspace project, that Flspace is capable of supporting required standards for industrial applications, and to identify where standards need to be modified or extended. The other deliverables are:

- D500.4.1 Guidelines to use of Standards in Flspace (available since M3), which provided a review of the relevant standards.
- D500.4.2 Recommendations for new or updated standards (available since M22).

The document results mainly from activities under Sub-Task 541 “Investigation on technology standards for cross-sectorial system and data integration”, and to a lesser extent from activities under Sub-Task 542 “Recommendations, collaboration and dissemination”, which have evaluated the support of standards in the final version of the Flspace platform and validated that the standards support from the Flspace platform addresses the requirements from the Open Call and Phase III Accelerator Application providers. This final validation is critical in determining the readiness of the Flspace platform for industrial roll-out and commercial deployment in support of multiple industrial sectors.

Requirements for support of standards were collected from the Open Call partners in the project for each of their applications / functionalities and were evaluated with respect to the ability of the Flspace platform to support the required standards. Similar requirements for support of standards were collected from the already selected for funding Phase III Application Accelerator providers, which reflect a broader set of target industrial sectors and standards requirements, and were also evaluated with respect to the ability of the Flspace platform to support the required standards.

1.2 Standards considered during evaluations

Many standardisation organisations in principle follow familiar steps (such as requirement analysis, solution development, IPR assessment, etc.), but they do not necessarily generate the same results. This may be due to differences between the nature of organisations, or due to a specific approach (e.g. formal or non-formal) towards standardisation processes. It can also be a result of an organisation’s participants aiming at specific standardisation deliverables (e.g. guidelines documents, interface specifications, fully described specification on which product compliance can be verified).

When carrying out the validation of standards supported by Flspace and the satisfaction of requirements for standards support from the application developers of the Open Call partners and Phase III Accelerator providers, the differences between types of standards bodies, as well as differences between the standardisation processes they support, and between the standardisation deliverables they produce must be considered.

1.2.1 Different types of standards bodies

On a European level, there are three formal standards organisations: CEN, CENELEC and ETSI. These are recognised by the European Commission and meet the World Trade Organisation criteria for standards setting. All three have cooperation arrangements in place with their global counterparts: ISO, IEC and ITU. In addition, there are several formal standards bodies working at a national level, which also have wider impact (e.g. DIN, ANSI or BSI). Formal standardisation processes require relatively long periods for approval processes to be completed although the open processes and draft publications can lead to earlier support of draft versions of the standard specifications.

Many aspects of ICT standardisation are covered by industry consortia and trade organisations (e.g. GS1, The Open Group, W3C), rather than formal standards bodies. Industry consortia do not primarily aim at producing formal standards, and many times set out to address or resolve only a limited number of specific issues. Despite the less formal character of the industry standards they produce, their strong focus on specific market segments or technical challenges often proves to be an efficient way for generating critical mass among stakeholders, necessary for successfully completing standardisation processes.

1.2.2 Different types of standardisation results

The ICT standardisation environment in which Flspace will operate is characterised by a large number of different standards bodies, generating an even larger number of standardisation activities and results. Even with these differences however, the outputs from these activities can be grouped as follows:

- **Formal standards**, sometimes also referred to as *de jure* standards, are normative documents from formal standards bodies and have passed through a full and open consensus process. They are implemented on a national level and there is strong pressure to apply them; formal standards have a legal basis and can be made mandatory, but considerable time (up to 4 years) is needed for completing the full approval process.
- **Technical or industry specifications** are based on consensus among members of standards bodies, consortia or trade organisations and do not have a formal character or legal basis; they are recommendations and require less time to produce (1-3 years), but when widely accepted and used in practice by relevant market actors they can become *de facto* standards.
- **Workshop Agreements** are industry recommendations developed by interested stakeholders through a short-track process (6-12 months) often facilitated by several formal standards bodies; workshop agreements serve as industrial consensus documents between participating individuals and organisations, and can be revised relatively easily.
- **Conformance, test applications, reference implementations and guidelines** aim to support interoperability between and easy rollout by market actors of products and services based on formal standards or industry specifications. They have an informative character and are usually produced in a relatively short timeframe (6-12 months).
- **Technical reports** are informative documents supporting further standardisation work, e.g. by identifying the need for additional technical clarifications in – or between – existing specifications, standards, or guideline documents.

Both formal standards and industry specifications that are developed in an open process and are publicly available under so called Fair, Reasonable and Non-Discriminatory (FRAND) terms, can be regarded as “open standards”. Nevertheless, there can be a trade-off between the impact of a formal standard, and the amount of time (and in some cases also resources) it takes to produce.

For the validation of the Flspace platform capabilities to support standards, each type of standards output has been considered when identified as a requirement from one or more of the Open Call or Phase III Accelerator Application providers.

1.2.3 Government prescribed standards

National governments often play an important role in establishing standards for industry. In some cases governments will mandate the use of specific standards developed by government recognised standards bodies related to safety, communications or other areas having a broad effect on society. Governments also influence standards through procurement where references to standards in government purchasing requirements can often motivate suppliers of products and technologies to comply with standards in order to be eligible for large government contracts for products and services.

While governments most often reference standards specified by recognised standards bodies such as CEN, CENELEC, ETSI or ISO, they sometimes establish standards directly through regulations that mandate specific information be supplied with products or that information concerning goods or materials be provided following specific categorisations or formats. In these cases the data categorisation or formats are defined by the government regulation itself, which provides as part of the mandate for compliance a standard specification for information exchange. Requirements for support of standards placed on the Flspace framework by the Open Call or Phase III Accelerator Application providers reflect standards coming from both standards bodies and those directly specified by government mandates, and both types of standards are addressed in this deliverable.

1.2.4 Emerging standards

The Flspace project is addressing state-of-the-art technologies for an Internet based framework to enable the development and deployment of business components and services, which is a relatively new field of technology development. Some of the most relevant technologies and specifications deployed within the Flspace platform are *de facto* standards that are recognised more for their widespread usage or acceptance, rather than having passed through a process of industry review and consensus or formal approvals. These emerging standards often have associated communities of users who create momentum for industry acceptance and adoption even though the standards development process is often no more structured than a website for downloading a specification, or an open source reference implementation and a discussion board where the main contributors to the specifications and industrial and academic users can interact. Nonetheless, there are several examples of successful industry standards that were established through very similar arrangements (e.g. Linux).

A natural progression for many of these emerging standards is that alternative implementations or specifications appear that are driven by different application domain specific requirements. When this occurs and the emerging standards reach a level of maturity, efforts to converge the various alternatives are undertaken. This convergence process functions quite similarly to the consensus process utilised by member based standards bodies, consortia or trade organisations.

The evaluations of the Flspace platform's ability to support standards has included emerging standards whose specifications and technologies are considered as established with substantial industrial use and acceptance as *de facto* standards. The Task 540 partners did not attempt to mitigate the views of Open Call partners or Phase III Accelerator providers with regard to which of the emerging standards were of sufficient maturity to be considered standards. As the viewpoints represented were a sample of the broader industry views, the characterisation of an emerging standard as a standard used for application development was sufficient for inclusion in the evaluations of Flspace support.

1.3 Categories of standards evaluated

A structured approach in identifying requirements for standards support was utilised in preparing this document. The intent was to address a wide range of standards in order to ensure the evaluation of the support for standards provided by the Flspace platform was representative of the types of demand for standards support likely to be encountered during commercial deployment of the Flspace platform. The collection of requirements for standards support from Open Call or Phase III Accelerator Application providers utilised a survey instrument with the following categories of standards.

Table 1: Categories of standards support evaluated

ID	Category	Description
1.	Product Identification Standards	Industry, national, European or international standards applications use to identify products (e.g. identification keys, electronic product codes, ISO 11784, etc.)
2.	Product Data Standards	Industry, national, European or international standards applications use for representing product data (e.g. product characteristics, logistics units, location, status, ambient data, etc.)
3.	Messaging Standards	Industry, national, European or international standards applications use to electronically exchange product related data (e.g. EDI, GS1 XML, agroXML, SensorML, etc.)
4.	Process Standards	Industry, national, European or international standards applications use to manage business processes (e.g. process models, BPMN, BPEL, XPDL)
5.	Application Development Standards	Industry or international standards used for developing applications (e.g. Java, Python, Eclipse, JSON, etc.)

ID	Category	Description
6.	Security Standards	Industry or international standards applications use for security (e.g. OAuth, OpenID, SAML, XACML, etc.)

In addition to the above categories, Open Call partners and Phase III Accelerator Application providers could also identify standards from categories not explicitly identified in the event there were requirements for industry sector specific standards or other standards under categories not listed.

1.4 Standards descriptions

The standards descriptions provided in this report have been collected from online sources including the originating organisation of the standards specification, community websites in the case of emerging open source standards, and other sources such as Wikipedia, where sufficient references are provided. The descriptions provided are synopses of available online information and links are provided for further detail descriptions of each standard evaluated.

1.5 Structure of this deliverable

The first part of this document describes the approach to standards that has been the basis for the development of the Flspace platform components. The second part describes and evaluates the required standards support for the Open Call partner applications and services. The third part describes and evaluates the required standards support for the Phase III Accelerator Applications. The final part of this document summarises the ability of the Flspace platform to support each of the required standards from the Open Call Application / Services and Accelerator Applications. Finally, more general recommendations for the support of standards are made.

2 Flspace platform standards support

2.1 Overview

Flspace offers a platform to facilitate business-to-business collaboration. It achieves this by offering the capability to define business processes that cross the borders of single businesses. In particular, actors from different businesses that use the Flspace platform can carry out collaborative processes together with the Flspace platform coordinating the interactions. The crossing of single business boundaries through innovative processes, and the exchange of the associated data involved is facilitated by the Flspace platform. To graphically support these processes from a user's perspective and to provide an interface that is not dependent on local premises systems, Flspace provides facilities for application developers to define tailor made pieces of specialized graphical user interface components, which are called widgets.

2.2 Core platform

The core Flspace platform utilises recognised industry standards for many parts of its internal implementation. However, the most critical areas related to standardisation in terms of industrial deployment is the capabilities for the platform to support industry standards used by typical application developers that are targeted during Phase III and beyond. The Flspace platform has been designed in accordance with the following principles:

- No data is stored in the platform for longer period then to handle the process
- The core platform in initial state has no knowledge about any process, message or anything that is domain specific
- Domain-specific plugins support the injection of domain-specific business processes into the platform
- Everything outside the core platform components connects to Flspace via a single access point

These principles have specific implications in terms of standards support provided for application developers:

- The Flspace platform is designed to transfer data between applications that then take appropriate actions within the application and provide visibility or notifications to the users as needed. Flspace does not impose any data formats for exchanging data between applications or devices and almost any type of data format or structure can be supported.
- The interfaces by which applications interact with the Flspace platform are few and very specific, whether exchanging information or utilising a graphical user interface component to display data to users. This provides isolation between the Flspace platform and the application such that the internal workings and protocols of an application are not visible to Flspace and other than the specific interfaces for interacting with the platform, very few restrictions are placed on the internal technologies or standards utilised by applications or the tools used for their development.

Functionalities provided by the core platform are distributed over a set of modules, which are connected via a bus. The following are the core modules of the Flspace platform:

- Frontend - Facilitates the user interface and supports process specific widgets
- SDI - System and Data Integration, provides the single access point from and to components outside the core platform
- B2B - Business to business collaboration support, which consists of business process support element and a complex event processor.
- Store - Facilitates definition of business processes and storage of data needed to create instances from them

Several of the core modules present interfaces based on standards for interacting and supporting the execution of Flspace applications.

In addition to the core modules, there is the Cloud Service Bus (CSB) that supports the interaction of Flspace components and Apps and also the security elements providing identity management for single sign-on of users to multiple applications, as well as securing and authenticating components for platform dependability. The Software Developers Kit (SDK) provides tools for developers to assist in developing widgets for Flspace and for business architects the tools to define and upload business process definitions.

2.3 Levels of standards support

The Flspace platform has been designed in many areas to be standards agnostic meaning it does not impose any standards on data formats for exchanging data between applications or devices, or require the use of specific technologies within the applications themselves. Application developers have tremendous freedom in deciding on the internal technologies to be utilised in their applications for Flspace.

The different levels of support for standards that were identified when Task 540 partners carried out the evaluations and validation of the required standards identified by the Open Call partners and Phase III Accelerator providers were as follows:

- **Supported** – a particular standard can be used in in developing and deploying a Flspace application without modification or adaptation.
- **Compatible** – a particular standard can be used in developing and deploying a Flspace application, however some adaptation may be needed to conform to Flspace design or architectural principles.
- **Not Compatible** – a particular standard cannot be used for developing a Flspace application as it is incompatible or conflicts with the Flspace design or architecture.

Where a standard has been assigned the level of Compatible or Not Compatible further explanations are provided as part of the evaluation, either for the specific standard, or the category of standards, if applicable.

3 Standards for Open Call applications

This chapter summarises the analysis of the results of a survey of required standards support that has been issued to all Open Call partners that joined the Flspace consortium to provide additional applications and features, along with testing and validation of the Flspace platform. These Open Call partners presented additional considerations for standards support beyond those addressed in the early stages of the project, which were described in deliverable D500.4.1.

3.1 Product Identification Standards

Figure 1 indicates the frequency of reference amongst the Open Call application providers for each of the product identification standards that were identified.

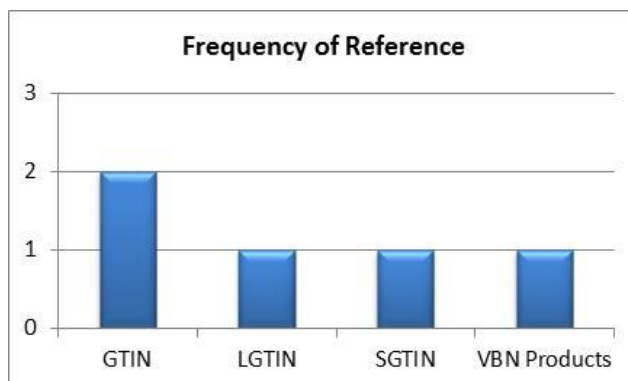


Figure 1: Frequency of reference to product identification standards by Open Call partners

The LGTIN and SGTIN standards are extensions of the GTIN standard from GS1 for capturing additional product details.

A description of the standards related to product identification in supply chains utilised by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 2.

Table 2: Product identification standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	GTIN	GS1 ¹	Global Trade Item Number (GTIN) can be used by a company to uniquely identify all of its trade items. Trade items are defined as products or services that are priced, ordered or invoiced at any point in the supply chain.	Supported
2	LGTIN	GS1	An extension to the Global Trade Item Number that includes the Batch/Lot related to a product.	Supported
3	SGTIN	GS1	An extension to the Global Trade Item Number that includes a unique product or serial number.	Supported
4	VBN Product Codes	VBN ²	Each flower and plant product traded through the floricultural auction is identified by its own VBN product code of almost 20,000 different plants and flowers.	Supported

¹ www.gs1.org

² www.vbn.nl

All of the above referenced product description standards are supported by the Flspace platform as no restrictions are placed on the structure and format of product information that can be utilised by applications, or exchanged between applications and users of the Flspace platform.

3.2 Product Data Standards

Figure 2 indicates the frequency of reference amongst the Open Call application providers for each of the product data standards that were identified.

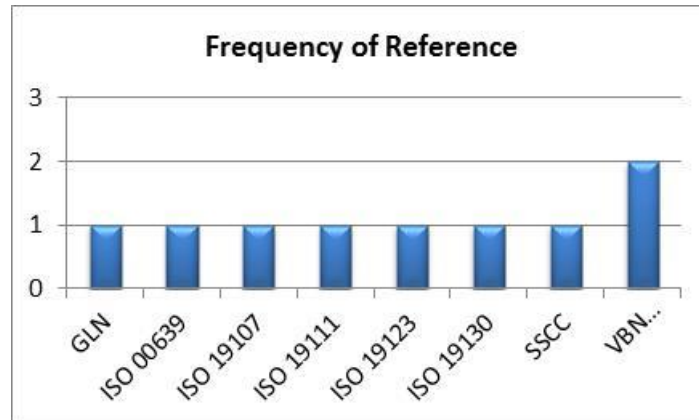


Figure 2: Frequency of reference to product data standards by Open Call partners

A description of the standards related to product data in supply chains identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 3.

Table 3: Product data standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	GLN	GS1	Global Location Number (GLN) can be used by companies to identify their locations, giving them complete flexibility to identify any type or level of location required.	Supported
2	ISO 00639	ISO ³	A set of standards concerned with representation of names for language and language groups. For example English is specified as being represented as "en" and "eng" within 2 and 3 character name spaces.	Supported
3	ISO 19107	ISO	Specifies conceptual schemas for describing the spatial characteristics (geometric and topological) of objects of up to three topological dimensions embedded in coordinate spaces of up to three axes.	Supported

³ www.iso.org

No.	Standard	Source	Description	Flspace Analysis
4	ISO 19111	ISO	Defines the conceptual schema for the description of spatial referencing by coordinates. It describes the minimum data required to define one-, two- and three-dimensional spatial coordinate reference systems with an extension to merged spatial-temporal reference systems.	Supported
5	ISO 19123	ISO	Defines a conceptual schema for the spatial characteristics of coverages. Coverages support mapping from a spatial, temporal or spatio-temporal domain to feature attribute values where feature attribute types are common to all geographic positions within the domain. A coverage domain consists of a collection of direct positions in a coordinate space.	Supported
6	ISO 19130	ISO	Identifies the information required to determine the relationship between the position of a remotely sensed pixel in image coordinates and its geoposition. It defines the metadata to be distributed with the image to enable user determination of geographic position from the observations.	Supported
7	SSCC	GS1	Serial Shipping Container Code (SSCC) can be used by companies to identify a logistic unit, which can be any combination of trade items packaged together for storage and/or transport purposes; for example a case, pallet or parcel.	Supported
8	VBN Characteristics Codes	VBN	Characteristic codes published by VBN describe certain aspects of the plant and flower products. Distinctions include sorting characteristics, botanical characteristics (including flower colour), quality characteristics and logistical characteristics (e.g. container codes).	Supported

All of the above referenced product data standards are supported by the Flspace platform as any type of product data regardless of structure and format can be utilised by applications, or exchanged between applications and users of the Flspace platform.

3.3 Messaging Standards

Figure 3 indicates the frequency of reference amongst the Open Call application providers for each of the messaging standards that were identified.

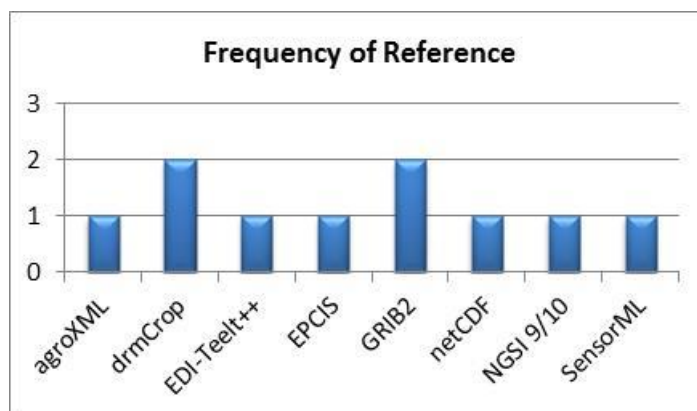


Figure 3: Frequency of reference to messaging standards by Open Call partners

A description of the standards related to messaging used in supply chains identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 4

Table 4: Messaging standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	agroXML	KTBL ⁴	agroXML is an XML dialect for representing and describing farm work. It can be used within farm management information systems as a file format for documentation purposes but also within web services and interfaces between the farm and external stakeholders as a means to exchange data in a structured and standardised manner.	Supported
2	drmCrop	AgroConnect ⁵	drmCrop is the basis for standardised messages for data exchange between farm applications and parties in the Netherlands. Messages are based on XML, but are also intended to use other methods of data exchange like JSON and RDF.	Supported
3	EDI-Teelt++	RVO ⁶	Reference model for smart farming initiatives providing a generic (cross-sector and chain) framework for computerization of smart farming.	Supported
4	EPCIS	GS1	Electronic Product Code Information Services (EPCIS) is an interface standard for creating and sharing visibility event data, both within and across enterprises, to enable users to gain a shared view of physical or digital objects within a relevant business context.	Supported

⁴ www.ktbl.de

⁵ www.agroconnect.nl

⁶ www.rvo.nl

No.	Standard	Source	Description	Flspace Analysis
5	GRIB	WMO ⁷	GRIB (GRIdded Binary or General Regularly-distributed Information in Binary form) is a concise data format commonly used in meteorology to store historical and forecast weather data.	Supported
6	netCDF	OGC ⁸	NetCDF is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data.	Supported
7	NGSI 9/10	OMA ⁹	Provides interfaces to manage context information about context entities. Through these interfaces, a context management component will provide its context management services to actors outside of a single network. These actors can: 1) provide context information (update operations); 2) consume context information (query and subscribe/notify operations); and 3) discover context entities through query or notifications (register and discover operations).	Supported
8	SensorML	OGC	Sensor Model Language (SensorML) provides a robust and semantically-tied means of defining processes and processing components associated with the measurement and post-measurement transformation of observations. This includes sensors and actuators as well as computational processes applied pre- and post-measurement.	Supported

All of the above referenced messaging standards are supported by the Flspace platform as messages supported by the Flspace platform can be tailored to address multiple formats for specific applications and no restrictions are placed on the content of messages exchanged by applications, devices or from external sources.

3.4 Business Process Standards

Figure 4 indicates the frequency of reference amongst the Open Call application providers for each of the business process standards that were identified.

⁷ www.wmo.int

⁸ www.opengeospatial.org

⁹ www.openmobilealliance.org

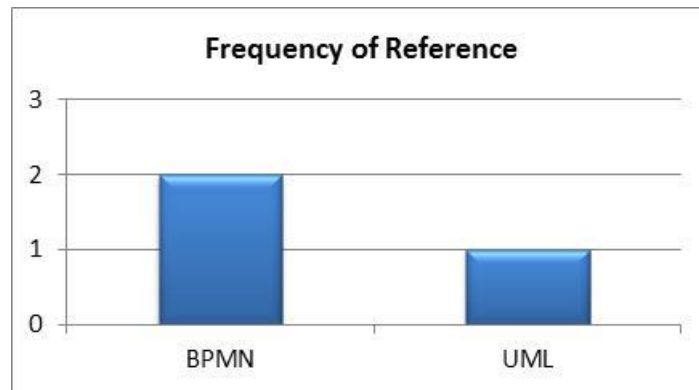


Figure 4: Frequency of reference to business process standards by Open Call partners

A description of the standards related to business processes used in supply chains identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 5.

Table 5: Business process standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	BPMN	OMG ¹⁰	The Business Process Modelling Notation (BPMN) is a graphical notation that depicts the steps in a business process. BPMN depicts the end-to-end flow of a business process. The notation has been specifically designed to coordinate the sequence of processes and the messages that flow between different process participants in a related set of activities.	Compatible The business processes defined using BPMN can be represented for use by the BPM and EPM modules to establish a business process, workflow and event processing for Flspace applications.
2	UML	OMG	The Unified Modelling Language (UML) is a general-purpose modelling language from the field of software engineering, provides a rich set of behavioural models which are very useful in modelling the processes, activities, people and information critical to every business	Compatible The business processes defined using UML can be represented for use by the BPM and EPM modules to establish a business process, workflow and event processing for Flspace applications.

The Flspace BPM and EPM modules support a wide range of business processes and workflows to be defined for Flspace applications. Some transformation of the notational formats used for representing business processes by the business process standards may be needed.

3.5 Application Development Standards

Standards for application development generally fall within five categories related to languages, development tools, remote services, data exchange, and data persistence. The standards referenced under each of these categories are evaluated with respect of the capabilities of the Flspace platform to support the identified standards in the following sections.

¹⁰ www.omg.org

3.5.1 Languages

Figure 5 indicates the frequency of reference amongst the Open Call application providers for each of the language standards that were identified.

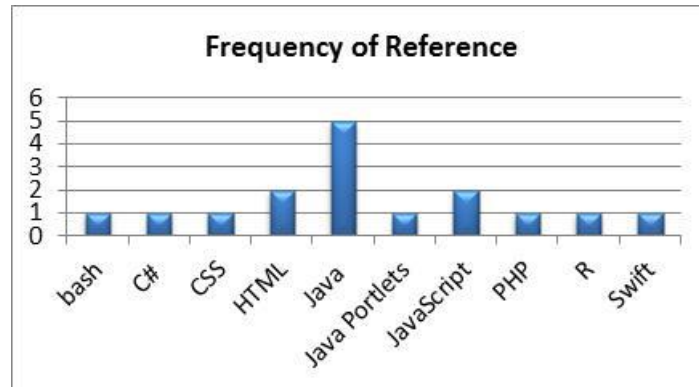


Figure 5: Frequency of reference to programming language standards by Open Call partners

A description of the languages used in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 6.

Table 6: Language standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	bash	GNU ¹¹	Bash is a Unix shell that has been distributed widely as a default shell on Linux and OS X. Bash is a command processor that typically runs in a text window, where the user types commands. Bash can also read commands from a script file and supports filename wildcarding, piping, here documents, command substitution, variables and control structures for condition-testing and iteration and is often used for scripting application module execution.	Compatible (see general comment below)
2	C#	ISO	C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved as a standard by Ecma (ECMA-334) and ISO (ISO/IEC 23270:2006).	Compatible (see general comment below)

¹¹ www.gnu.org/software/bash

No.	Standard	Source	Description	Flspace Analysis
3	CSS	W3C ¹²	Cascading Style Sheets (CSS) is a language used for describing the look and formatting of a document written in a markup language. While most often used to change the style of web pages and user interfaces written in HTML, the language can be applied to any kind of XML document, including plain XML, SVG and XUL. Along with HTML and JavaScript, CSS is a cornerstone technology used by most websites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications.	Supported
4	HTML	W3C	HyperText Markup Language (HTML) is the standard markup language used to create web pages. Web browsers can read HTML files and render them into visible or audible web pages. Browsers do not display the HTML tags and scripts, but use them to interpret the content of the page. HTML describes the structure of a website semantically along with cues for presentation, making it a markup language, rather than a programming language.	Supported
5	Java	JCP ¹³	Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. Java applications are typically compiled to bytecode that can run on any Java virtual machine (JVM) regardless of computer architecture.	Supported
6	Java Portlets	JCP	Java portlets are web-based components that enable integration between applications and portals and thus enable delivery of applications on portals. Usually, many portlets are invoked in the single request of a portal page. Each portlet produces a fragment of markup that is combined with the markup of other portlets, all within the portal page markup.	Not Compatible Flspace platform provides an alternative mechanism for representing application components on the Flspace portal.

¹² www.w3.org

¹³ www.jcp.org

No.	Standard	Source	Description	Flspace Analysis
7	JavaScript	ECMA ¹⁴	JavaScript is a dynamic programming language most commonly used as part of web browsers, whose implementations allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the document content that is displayed. It is also used in server-side network programming with runtime environments.	Supported
8	PHP	PHP Group ¹⁵	PHP is a scripting language designed for web development but also used as a general-purpose programming language. PHP code can be simply mixed with HTML code, or it can be used in combination with various templating engines and web frameworks.	Supported
9	R	R Project ¹⁶	R is a programming language for statistical computing and graphics. The R language is widely used among statisticians and data miners for developing statistical software and data analysis.	Compatible
10	Swift	Apple ¹⁷	Swift is a multi-paradigm, compiled programming language created by Apple for iOS and OS X development. Swift is designed to work with the large body of existing Objective-C code written for Apple products and is intended to be more resilient to erroneous code than Objective-C, and also more concise.	Compatible

Overall the Flspace platform is able to support applications using the Java programming language and other languages commonly used for web applications (HTML, JavaScript, PHP, etc). Most programming languages are compatible with Flspace provided they include capabilities to utilise a RESTful interface for interacting with the Cloud Service Bus (CSB) of the Flspace platform. In the case of Java Portlets the Flspace platform provides an alternative mechanism, which is not compatible.

3.5.2 Development Tools

Figure 6 indicates the frequency of reference amongst the Open Call application providers for each of the development tool standards (i.e. integrated development environments, development frameworks and build tools) that were identified.

¹⁴ www.ecma-international.org

¹⁵ www.php.net

¹⁶ www.r-project.org

¹⁷ www.apple.com/swift

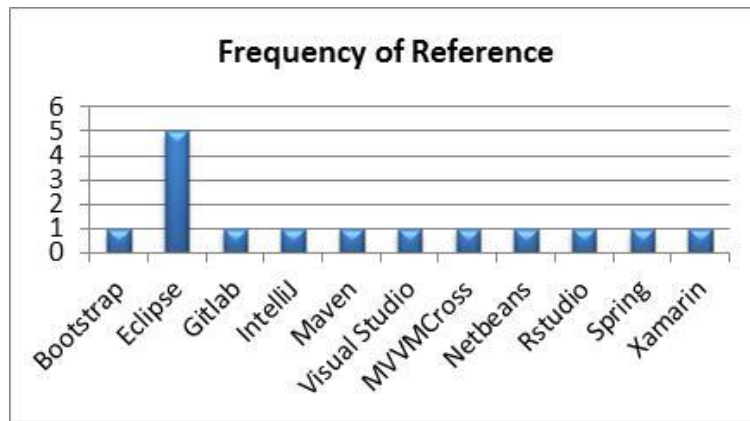


Figure 6: Frequency of reference to development tool standards by Open Call partners

A description of the development tools used in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 7.

Table 7: Development tool standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	Bootstrap	Github ¹⁸	Bootstrap is an open-source collection of tools for creating websites and web applications. It contains HTML- and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Bootstrap is a front end, which is an interface between the user and the server-side code which resides on the server.	Compatible The HTML and CSS-based design templates could be used with Flspace.
2	Eclipse	Eclipse Foundation ¹⁹	Eclipse is an integrated development environment (IDE) that contains a base workspace and an extensible plug-in system for customizing the environment. Originally intended for Java development, by means of various plug-ins, Eclipse may also be used to develop applications in other programming languages. Development environments include the Eclipse Java development tools (JDT) for Java and Scala, Eclipse CDT for C/C++ and Eclipse PDT for PHP, among others.	Supported

¹⁸ Accessible via www.getbootstrap.com

¹⁹ www.eclipse.org

No.	Standard	Source	Description	Flspace Analysis
3	GitLab	GitLab ²⁰	GitLab is a web-based Git repository manager with wiki and issue tracking features. GitLab is similar to GitHub, but GitLab has an open source version, unlike GitHub, as well as a proprietary commercial version. It provides features for repository management, code reviews, issue tracking, activity feeds and wikis. Can be integrated with Eclipse using the EGit plug-in for Eclipse.	Compatible Using the EGit plugin the GitLab environment would be compatible with Eclipse, which is supported by the Flspace platform.
4	IntelliJ	Jetbrains ²¹	IntelliJ is a Java integrated development environment (IDE) and is available as open source community edition, and in a proprietary commercial edition. It includes features for code analysis, refactoring, version control and build management. It provides support for integration with Eclipse.	Compatible The integration capability with Eclipse, which is supported by the Flspace platform, provides compatibility.
5	Maven	Apache ²²	Maven is a software project management and comprehension tool. Based on the concept of a project object model (POM), Maven can manage a project's build, reporting and documentation from a central server. It provides support for integration with Eclipse.	Compatible The integration capability with Eclipse, which is supported by the Flspace platform, provides compatibility.
6	Visual Studio	Microsoft ²³	Microsoft Visual Studio is an integrated development environment (IDE) used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.	Not Compatible The IDE relies on underlying capabilities from Microsoft such as Silverlight and Presentation Foundation which are not compatible with the open Flspace architecture.

²⁰ www.gitlab.com

²¹ www.jetbrains.com

²² Access via <http://maven.apache.org>

²³ www.visualstudio.com

No.	Standard	Source	Description	Flspace Analysis
7	MVVMCross	Github ²⁴	MVVMCross is a MVVM ²⁵ platform that addresses issues faced when developing for cross platforms (such as Android, Windows Phone or IOS). Each platform has its own specifications, that's why you cannot simply write one code and run it on multiple platforms as is. The main feature is to separate logic not only from the views (as in MVVM and MVC patterns), but from specific platform implementation. The business logic will be implemented in a PCL (Portable Library Class), and each platform can reference it as its logic, while implementing its native side accordingly.	Compatible The native side code that would interact with the generated PCL could be implemented to be compatible with Flspace.
8	Netbeans	Netbeans.org ²⁶	NetBeans is a software development platform that NetBeans Platform allows applications to be developed from a set of modular software components called modules. NetBeans IDE supports development of all Java application types out of the box, also support for C/C++, and PHP is provided. Among other features are an Ant-based project system, Maven support, refactoring, and version control.	Supported
9	Rstudio	Rstudio ²⁷	RStudio is an open source integrated development environment (IDE) for R, a programming language for statistical computing and graphics. RStudio is available in two editions: RStudio Desktop, where the program is run locally as a regular desktop application; and RStudio Server, which allows accessing RStudio using a web browser while it is running on a remote Linux server.	Compatible The StatET plugin for Eclipse, which is support by Flspace, provides R support and integration with Rstudio.

²⁴ Access via <http://github.com/MvvmCross>

²⁵ Model View ViewModel (MVVM) is an architectural pattern that facilitates a separation of the development of the graphical user interface (either as markup language or GUI code) from the development of the business logic or back-end logic (the data model).

²⁶ www.netbeans.org

²⁷ www.rstudio.com

No.	Standard	Source	Description	Flspace Analysis
10	Spring	Spring.io ²⁸	The Spring Framework is an application framework and inversion of control container for the Java platform. The framework's core features can be used by any Java application, but there are extensions for building web applications on top of the Java EE platform. Although the framework does not impose any specific programming model, it has become popular in the Java community as an alternative to, replacement for, or even addition to the Enterprise JavaBean (EJB) model. The Spring Framework is open source.	Supported
11	Xamarin	Xamarin ²⁹	Xamarin is a cross-platform implementations of the Common Language Infrastructure (CLI) and Common Language Specifications (often called Microsoft .NET). Building from a C# shared codebase, developers can use Xamarin tools to write native iOS, Android, and Windows apps with native user interfaces and share code across multiple platforms. Xamarin claims to be the only IDE that allows for native iOS, Android and Windows app development within Microsoft Visual Studio.	Not Compatible The IDE relies on underlying capabilities from Microsoft which are not compatible with the open Flspace architecture.

The use of Eclipse within Flspace provides support for the most popular integrated development environment standard, and many other tools are either built using Eclipse or have extensions that support integration with the Eclipse environments. Environments that rely on Microsoft technologies, which are not compatible with the open Flspace architecture, are not compatible in terms of exploiting the full features of the Flspace platform.

3.5.3 Remote Services

Figure 7 indicates the frequency of reference amongst the Open Call application providers for each of the remote services standards that were identified.

²⁸ www.spring.io

²⁹ www.xamarin.com

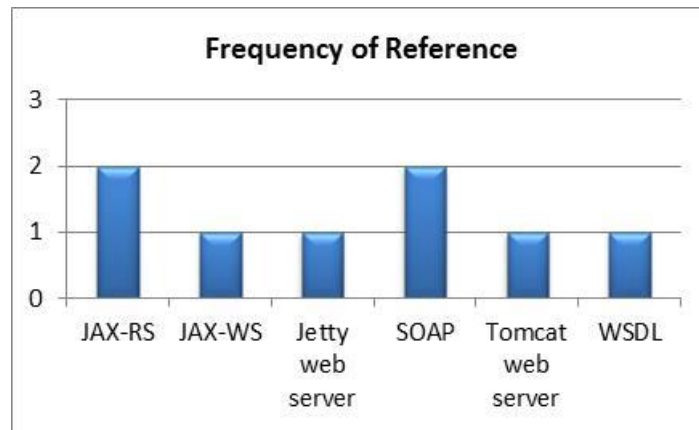


Figure 7: Frequency of reference to remote services standards by Open Call partners

A description of the remote services standards used in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 8.

Table 8: Remote services standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	JAX-RS	JCP ³⁰	Java API for RESTful Web Services (JAX-RS) is a Java programming language API that provides support in creating web services according to the Representational State Transfer (REST) architectural pattern. JAX-RS uses annotations to simplify the development and deployment of web service clients and endpoints.	Supported
2	JAX-WS	JCP	Java API for XML Web Services (JAX-WS) is a Java programming language API for creating web services using a standard Java-to-WSDL mapping that determines how WSDL operations are bound to Java methods when a SOAP message invokes a WSDL operation.	Supported
3	Jetty web server	Eclipse Foundation ³¹	Jetty is a Java HTTP Web server and Java Servlet container. Jetty is often used for machine to machine communications, usually within larger software frameworks. Jetty is developed as an open source project as part of the Eclipse Foundation.	Supported

³⁰ www.jcp.org

³¹ www.eclipse.org

No.	Standard	Source	Description	Flspace Analysis
4	SOAP	W3C ³²	SOAP (Simple Object Access protocol) is a protocol specification for exchanging structured information in the implementation of web services in computer networks. It uses XML for its message format, and relies on other application layer protocols, most notably Hypertext Transfer Protocol (HTTP) for message negotiation and transmission.	Supported
5	Tomcat web server	Apache ³³	Apache Tomcat is an open source web server and servlet container developed by the Apache Software Foundation. Tomcat implements several Java specifications including Java Servlet, JavaServer Pages (JSP), Java EL, and WebSocket, and provides a "pure Java" HTTP web server environment for Java code to run in.	Supported
6	WSDL	W3C ³⁴	Web Services Description Language (WSDL) is an XML-based interface definition language that is used for describing the functionality offered by a web service. It provides a machine-readable description of how the service can be called, what parameters it expects, and what data structures it returns.	Supported

The above referenced standards are widely used for Web Services based frameworks and are standards used in the implementation of the Flspace platform.

3.5.4 Data Exchange

Figure 8 indicates the frequency of reference amongst the Open Call application providers for each of the standards for data exchange that were identified. These generic data format standards are often utilised for constructing domain-specific messaging standards.

³² www.w3.org

³³ Accessible via <http://tomcat.apache.org>

³⁴ www.w3.org

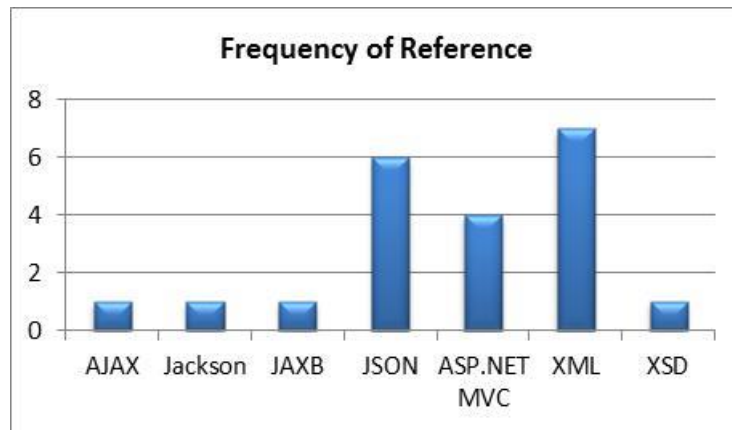


Figure 8: Frequency of reference to data exchange standards by Open Call partners

A description of the standards used for data exchange in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 9.

Table 9: Data exchange standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	AJAX	W3C ³⁵	Asynchronous JavaScript and XML (AJAX) is a group of interrelated Web development techniques used on the client-side to create asynchronous Web applications. With AJAX, web applications can send data to and retrieve from a server asynchronously (in the background) without interfering with the display and behaviour of the existing page. Despite the name, the use of XML is not required (JSON is often used in the AJAJ variant), and the requests do not need to be asynchronous.	Supported
2	Jackson	Github ³⁶	Jackson was formerly known as the standard JSON library for Java and is a suite of data-processing tools including the streaming JSON parser / generator library, matching data-binding library and additional data format modules to process data encoded in Avro, CBOR, CSV, Smile, XML or YAML, and many more.	Supported

³⁵ www.w3.org

³⁶ Access via <http://github.com/FasterXML/jackson>

No.	Standard	Source	Description	Flspace Analysis
3	JAXB	JCP ³⁷	Java Architecture for XML Binding (JAXB) allows Java developers to map Java classes to XML representations. JAXB provides two main features: the ability to marshal Java objects into XML and the inverse, i.e. to unmarshal XML back into Java objects. In other words, JAXB allows storing and retrieving data in memory in any XML format, without the need to implement a specific set of XML loading and saving routines for the program's class structure.	Supported
4	JSON	ECMA ³⁸	JavaScript Object Notation (JSON), is an open standard format that uses human-readable text to transmit data objects consisting of attribute–value pairs. It is used primarily to transmit data between a server and web application, as an alternative to XML. JSON is a language-independent data format.	Supported
5	ASP.NET MVC	Microsoft ³⁹	ASP.NET is an open source server-side Web application framework from Microsoft designed for Web development to produce dynamic Web pages. It allows programmers to build dynamic web sites, web applications and web services. ASP.NET MVC is the web application framework that implements the model–view–controller (MVC) pattern.	Not Compatible The ASP.NET standard relies on an underlying .Net environment that is not compatible with Flspace.
6	XML	W3C	Extensible Markup Language (XML) defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. The design goals of XML emphasize simplicity, generality and usability across the Internet. It is a textual data format with strong support via Unicode for different human languages. Although the design of XML focuses on documents, it is widely used for the representation of arbitrary data structures such as those in web services.	Supported

³⁷ www.jcp.org

³⁸ www.json.org

³⁹ www.asp.net/mvc

No.	Standard	Source	Description	Flspace Analysis
7	XSD	W3C	XML Schema Definition (XSD) specifies how to formally describe the elements in an Extensible Markup Language (XML) document. It can be used by programmers to verify each piece of item content in a document adheres to the description of the element it is placed in. XSD can be used to express a set of rules to which an XML document must conform in order to be considered "valid" according to that schema.	Supported

The Flspace platform supports multiple types of data interchange standards, however the ASP.NET standard relies on an underlying .Net environment being available, which is not compatible with Flspace.

3.5.5 Data Persistence

Figure 9 indicates the frequency of reference amongst the Open Call application providers for each of the data persistence standards that were identified.

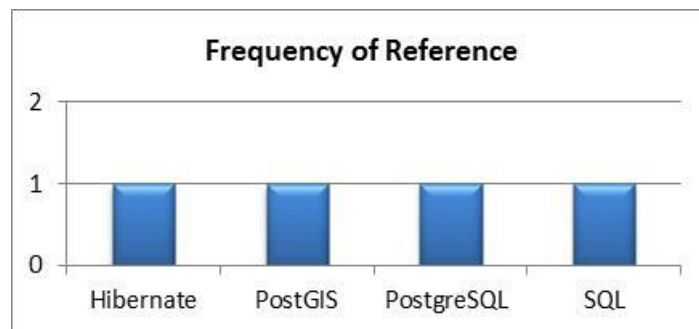


Figure 9: Frequency of reference to data persistence standards by Open Call partners

A description of the data persistence standards used in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 10.

Table 10: Data persistence standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	Hibernate	Red Hat ⁴⁰	Hibernate is an object-relational mapping framework for the Java language, providing a framework for mapping an object-oriented domain model to a traditional relational database. Hibernate solves object-relational impedance mismatch problems by replacing direct persistence-related database accesses with high-level object handling functions. Hibernate's primary feature is mapping from Java classes to database tables (and from Java data types to SQL data types). Hibernate also provides data query and retrieval facilities.	Compatible
2	PostGIS	OSGeo ⁴¹	PostGIS is a spatial database extender for PostgreSQL object-relational database (see below). It adds support for geographic objects allowing location queries to be run in SQL.	Compatible
3	PostgreSQL	PostgreSQL Community ⁴²	PostgreSQL is an open source object-relational database system. It has a strong reputation for reliability, data integrity, and correctness. It runs on all major operating systems and is fully ACID compliant, has full support for foreign keys, joins, views, triggers, and stored procedures (in multiple languages).	Compatible
4	SQL	ISO ⁴³	Structured Query Language (SQL) is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). Originally based upon relational algebra and tuple relational calculus, SQL consists of a data definition language and a data manipulation language. The scope of SQL includes data insert, query, update and delete, schema creation and modification, and data access control.	Compatible

⁴⁰ www.hibernate.org

⁴¹ www.osgeo.org

⁴² www.postgresql.org

⁴³ www.iso.org

In general, the Flspace platform does not store application specific data so the choice of data persistence standards is a technology decision that can be taken by application developers largely independent of the Flspace platform.

3.6 Security Standards

Figure 10 indicates the frequency of reference amongst the Open Call application providers for each of the security standards that were identified.

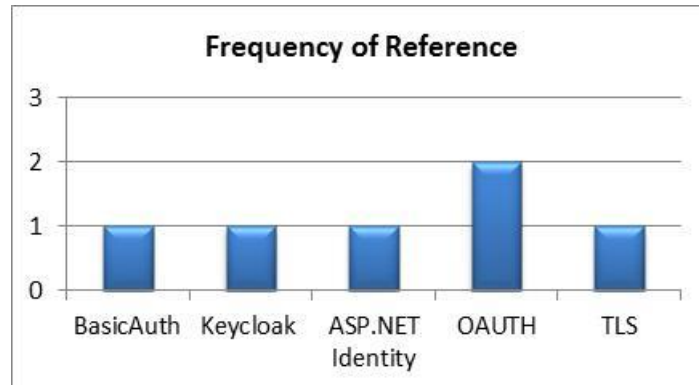


Figure 10: Frequency of reference to security standards by Open Call partners

A description of the security standards used in supply chain applications that have been identified by Open Call application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 11.

Table 11: Security standards used by Open Call partners

No.	Standard	Source	Description	Flspace Analysis
1	BasicAuth	IETF ⁴⁴	BasicAuth is defined in the Hyper-text Transfer Protocol (HTTP) standard. When a client connects to a web server, it sends a "WWW-Authenticate: Basic" message in the HTTP header. Shortly after that, it sends login credentials to the server using a mild obfuscation technique encoding. When HTTPS is used, these credentials are protected, so it's not considered insecure, which is why BasicAuth gained widespread use over the years.	Not Compatible Issues exist with logging off as browsers tend to cache sessions creating security vulnerabilities allowing another user log in by re-freshing the browser.
2	Keycloak	Red Hat ⁴⁵	An integrated Single Sign-on (SSO) and Identity Management (IDM) technology for browser apps and RESTful web services. Built on top of the OAuth 2.0, Open ID Connect, JSON Web Token (JWT) and SAML 2.0 specifications.	Supported

⁴⁴ www.ietf.org

⁴⁵ www.hibernate.org

No.	Standard	Source	Description	Flspace Analysis
3	ASP.NET Identity	Microsoft ⁴⁶	The ASP.NET Identity system is designed to replace the previous ASP.NET Membership and Simple Membership systems. It includes profile support, OAUTH integration, works with OWIN, and is included with the ASP.NET templates shipped with Visual Studio.	Not Compatible The ASP.NET standard relies on an underlying .Net environment that is not compatible with Flspace.
4	OAUTH	IETF	OAuth is an open standard for authorisation that provides client applications a 'secure delegated access' to server resources on behalf of a resource owner. It specifies a process for resource owners to authorise third-party access to their server resources without sharing their credentials. Designed specifically to work with Hypertext Transfer Protocol (HTTP), OAuth essentially allows access tokens to be issued to third-party clients by an authorisation server, with the approval of the resource owner, or end-user.	Supported
5	TLS	IETF	Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols designed to provide communications security over a computer network. They use X.509 certificates and asymmetric cryptography to authenticate the counterparty with whom they are communicating, and to negotiate a symmetric key. This session key is then used to encrypt data flowing between the parties. This allows for data/message confidentiality and message authentication codes for message integrity and as a by-product, message authentication.	Supported

The Flspace platform utilises TLS, OAUTH and KeyCloak for implementing security features so these standards are fully supported. BasicAuth is not compatible due to security vulnerabilities, and the ASP.NET standard relies on an underlying .Net environment, which is not compatible with Flspace.

⁴⁶ www.asp.net

4 Standards for Phase III Accelerator applications

This chapter summarises the analysis of the results of a survey that has been issued to Phase III Accelerator application providers, which have been selected for funding and who intend to utilise the Flspace platform. The accelerator applications that will be developed represent additional requirements beyond those addressed by the project partners as they target additional features and a broader additional set of application domains.

4.1 Product Identification Standards

Figure 11 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the product identification standards that were identified.

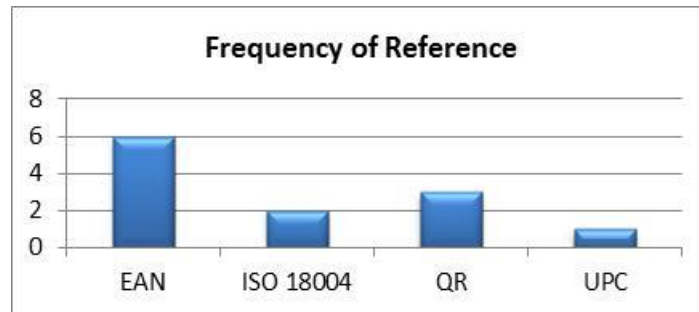


Figure 11: Frequency of reference to product identification standards by Phase III Accelerator providers

A description of the standards related to product identification in supply chains utilised by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 12.

Table 12: Product identification standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	EAN-13	GS1 ⁴⁷	An EAN-13 barcode is a 13 digit barcoding standard which is a superset of the original 12-digit Universal Product Code (UPC) system developed in 1970. EAN-13 barcodes are used worldwide for marking products often sold at retail point of sale.	Supported
2	ISO/IEC 18004	ISO ⁴⁸	Formal ISO/IEC standard of the QR Code (Quick Response) specification. It became an ISO/IEC standard in 2000. QR Code is a square barcode, which is made up of black modules (square dots/pixels), arranged in a square pattern on a white background.	Supported
3	GS1 QR Code	GS1	A GS1 QR Code is subset of the QR Code supporting GS1 Identification Schemes and Application Identifiers.	Supported

⁴⁷ www.gs1.org

⁴⁸ www.iso.org

No.	Standard	Source	Description	Flspace Analysis
4	UPC	GS1	Universal Product Code (UPC) is a barcode that is widely used for tracking trade items. Its most common form, the UPC-A, consists of 12 numerical digits, which are uniquely assigned to each trade item.	Supported

All of the above referenced product description standards are supported by the Flspace platform as no restrictions are placed on the structure and format of product information that can be utilised by applications, or exchanged between applications and users of the Flspace platform.

4.2 Product Data Standards

Figure 12 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the product data standards that were identified.

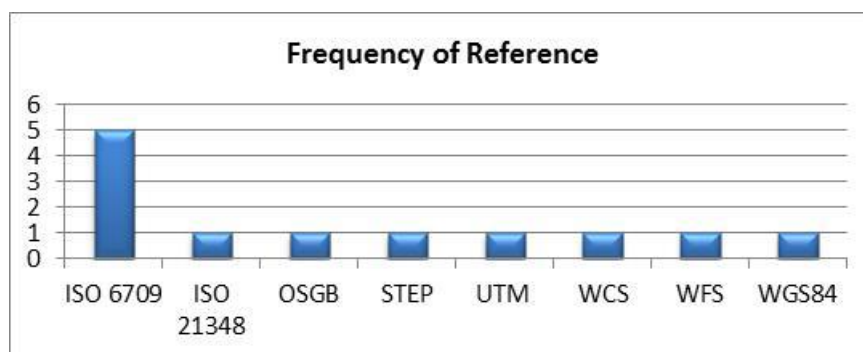


Figure 12: Frequency of reference to product data standards by Phase III Accelerator providers

A description of the standards related to product data in supply chains identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 13.

Table 13: Product data standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	ISO 6709	ISO ⁴⁹	International standard for representation of latitude, longitude and altitude for geographic point locations.	Supported
2	ISO 21348	ISO	International standard for specification of type of light (wavelength).	Supported
3	OSGB	Ordnance Survey ⁵⁰	Ordnance Survey National Grid reference system is a system of geographic grid references used in Great Britain, different from using Latitude and Longitude.	Supported

⁴⁹ www.iso.org

⁵⁰ www.ordnancesurvey.co.uk

No.	Standard	Source	Description	Flspace Analysis
4	STEP	ISO	Common name for ISO 10903 standard for the computer-interpretable representation and exchange of product manufacturing information. It can represent 3D objects in Computer-aided design (CAD) and related information.	Supported
5	UTM	U.S. Geological Survey	Universal Transverse Mercator (UTM) conformal projection uses a 2-dimensional Cartesian coordinate system to give locations on the surface of the Earth. It is a horizontal position representation, i.e. it is used to identify locations on the Earth independently of vertical position, but differs from the traditional method of latitude and longitude in several respects.	Supported
6	WCS	OGC ⁵¹	WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients.	Supported
7	WFS	OGC	Web Feature Service (WFS) specification provides an interface allowing requests for geographical features across the web using platform-independent calls.	Supported
8	WGS84	National Geospatial-Intelligence Agency ⁵²	WGS 84 is currently the reference system being used by the Global Positioning System (GPS). It is geocentric and globally consistent within ± 1 m.	Supported

All of the above referenced product data standards are supported by the Flspace platform as any type of product data regardless of structure and format can be utilised by applications, or exchanged between applications and users of the Flspace platform.

4.3 Messaging Standards

Figure 13 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the messaging standards that were identified.

⁵¹ www.opengeospatial.org

⁵² www.nga.mil

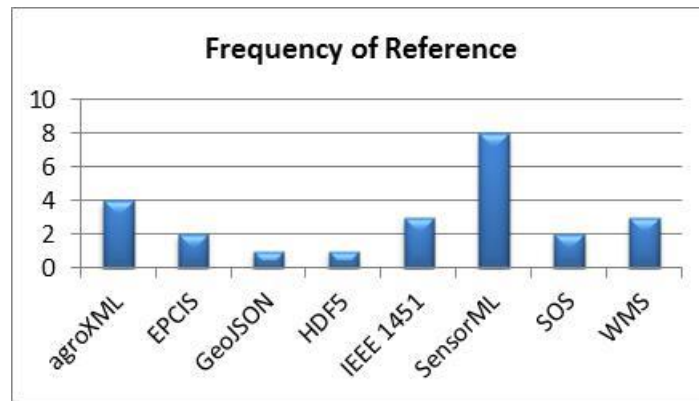


Figure 13: Frequency of reference to messaging standards by Phase III Accelerator providers

A description of the standards related to messaging used in supply chains identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 14.

Table 14: Messaging standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	agroXML	KTBL ⁵³	agroXML is an XML dialect for representing and describing farm work. It can be used within farm management information systems as a file format for documentation purposes but also within web services and interfaces between the farm and external stakeholders as a means to exchange data in a structured and standardised manner.	Supported
2	EPCIS	GS1	Electronic Product Code Information Services (EPCIS) is an interface standard for creating and sharing visibility event data, both within and across enterprises, to enable users to gain a shared view of physical or digital objects within a relevant business context	Supported
3	GeoJSON	GeoJSON Community ⁵⁴	GeoJSON is a format for encoding collections of simple geographical features along with their non-spatial attributes using JavaScript Object Notation. The features include points (therefore addresses and locations), line strings (therefore streets, highways and boundaries), polygons (countries, provinces, tracts of land), and multi-part collections of these types.	Supported

⁵³ www.ktbl.de

⁵⁴ www.geojson.org

No.	Standard	Source	Description	Flspace Analysis
4	HDF5	HDF Group ⁵⁵	Hierarchical Data Format (HDF) is a file format designed to store and organise large amounts of numerical data. It uses a hierarchical, file system-like data format.	Supported
5	IEEE 1451	IEEE ⁵⁶	A set of smart transducer interface standards describing a set of open, common, network-independent communication interfaces for connecting transducers (sensors or actuators) to microprocessors, instrumentation systems, and control/field networks.	Supported
6	SensorML	OGC ⁵⁷	Sensor Model Language (SensorML) provides a robust and semantically-tied means of defining processes and processing components associated with the measurement and post-measurement transformation of observations. This includes sensors and actuators as well as computational processes applied pre- and post-measurement.	Supported
7	SOS	OGC	The Sensor Observation Service (SOS) defines a Web service interface which allows querying observations, sensor metadata, as well as representations of observed features. Further, this standard defines means to register new sensors and to remove existing ones. Two bindings are specified: KVP binding and SOAP binding.	Supported
8	WMS	OGC ⁵⁸	Web Map Service (WMS) is a standard protocol for serving geo-referenced map images over the Internet that are generated by a map server using data from a GIS database.	Supported

All of the above referenced messaging standards are supported by the Flspace platform as messages supported by the Flspace platform can be tailored to address multiple formats for specific applications and no restrictions are placed on the content of messages exchanged by applications, devices or from external sources.

⁵⁵ www.hdfgroup.org

⁵⁶ www.ieee.org

⁵⁷ www.opengeospatial.org

⁵⁸ www.opengeospatial.org

4.4 Business Process Standards

Figure 14 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the process standards that were identified.

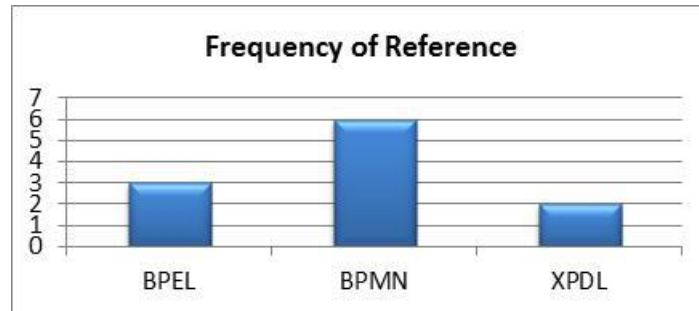


Figure 14: Frequency of reference to business process standards by Phase III Accelerator providers

A description of the standards related to business processes used in supply chains identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 15.

Table 15: Business process standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	BPEL	OASIS ⁵⁹	BPEL (Business Process Execution Language) is an executable language for specifying actions within business processes with web services. Processes in BPEL export and import information by using web service interfaces exclusively.	Compatible The business processes defined using BPEL can be represented for use by the BPM and EPM modules to establish a business process, workflow and event processing for Flspace applications.
2	BPMN	OMG ⁶⁰	The Business Process Modelling Notation (BPMN) is a graphical notation that depicts the steps in a business process. BPMN depicts the end-to-end flow of a business process. The notation has been specifically designed to coordinate the sequence of processes and the messages that flow between different process participants in a related set of activities.	Compatible The business processes defined using BPMN can be represented for use by the BPM and EPM modules to establish a business process, workflow and event processing for Flspace applications.

⁵⁹ www.oasis-open.org

⁶⁰ www.omg.org

No.	Standard	Source	Description	Flspace Analysis
3	XPDL	WfMC ⁶¹	XML Process Definition Language (XPDL) is a format to interchange business process definitions between different workflow products, i.e. between different modelling tools and management suites. XPDL defines an XML schema for specifying the declarative part of workflow / business process.	Compatible The business processes defined using XPDL can be represented for use by the BPM and EPM modules to establish a business process, workflow and event processing for Flspace applications.

The Flspace BPM and EPM modules support a wide range of business processes and workflows to be defined for Flspace applications. Some transformation of the notational formats used for representing business processes by the business process standards may be needed.

4.5 Application Development Standards

Standards for application development generally fall within five categories related to languages, development tools, remote services, data exchange, and data persistence. The standards referenced under each of these categories are evaluated with respect of the capabilities of the Flspace platform to support the identified standards in the following sections.

4.5.1 Languages

Figure 15 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the language standards that were identified.

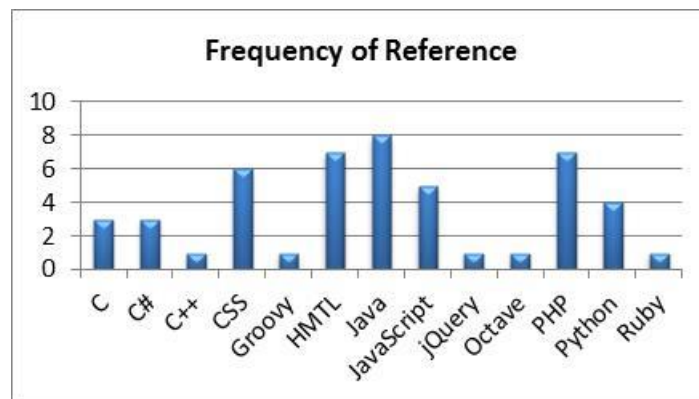


Figure 15: Frequency of reference to language standards by Phase III Accelerator providers

A description of the languages used in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 16.

⁶¹ www.wfmc.org

Table 16: Language standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	C	ISO ⁶²	C is a general-purpose programming language that supports structured programming, lexical variable scope and recursion, while a static type system prevents many unintended operations. C provides constructs that map efficiently to typical machine instructions, and therefore is often used in applications that had formerly been coded in assembly language, including operating systems, as well as applications ranging from supercomputers to embedded systems.	Compatible (see general comment below)
2	C#	ISO	C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved as a standard by Ecma (ECMA-334) and ISO (ISO/IEC 23270:2006).	Compatible (see general comment below)
3	C++	ISO	The C++ programming language provides a model of memory and computation that closely matches that of most computers and mechanisms for abstraction and object-oriented programming that allow the programmer to introduce and use types of objects that match the concepts of an application.	Compatible (see general comment below)
4	CSS	W3C ⁶³	Cascading Style Sheets (CSS) is a language used for describing the look and formatting of a document written in a markup language. While most often used to change the style of web pages and user interfaces written in HTML, the language can be applied to any kind of XML document, including plain XML, SVG and XUL. Along with HTML and JavaScript, CSS is a cornerstone technology used by most websites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications.	Supported

⁶² www.iso.org

⁶³ www.w3.org

No.	Standard	Source	Description	Flspace Analysis
5	GNU Octave	GNU ⁶⁴	GNU Octave is a high-level programming language, primarily intended for numerical computations. It provides a command-line interface for solving linear and nonlinear problems numerically, and for performing other numerical experiments using a language that is mostly compatible with MATLAB, as it is one of the two major open-source alternatives to MATLAB.	Compatible (see general comment below)
6	Groovy	Groovy Community ⁶⁵	Groovy is an object-oriented programming language for the Java platform. It is a dynamic language with features similar to those of Python, Ruby, Perl, and Smalltalk. It can be used as a scripting language for the Java Platform, is dynamically compiled to Java Virtual Machine (JVM) bytecode, and interoperates with other Java code and libraries. Most Java code is also syntactically valid Groovy, although semantics may be different.	Compatible (see general comment below)
7	HTML	W3C	HyperText Markup Language (HTML) is the standard markup language used to create web pages. Web browsers can read HTML files and render them into visible or audible web pages. Browsers do not display the HTML tags and scripts, but use them to interpret the content of the page. HTML describes the structure of a website semantically along with cues for presentation, making it a markup language, rather than a programming language.	Supported
8	Java	JCP ⁶⁶	Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. Java applications are typically compiled to bytecode that can run on any Java virtual machine (JVM) regardless of computer architecture.	Supported

⁶⁴ www.gnu.org

⁶⁵ www.groovy-lang.org

⁶⁶ www.jcp.org

No.	Standard	Source	Description	Flspace Analysis
9	JavaScript	ECMA ⁶⁷	JavaScript is a dynamic programming language most commonly used as part of web browsers, whose implementations allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the document content that is displayed. It is also used in server-side network programming with runtime environments.	Supported
10	jQuery	jQuery Foundation ⁶⁸	jQuery is a cross-platform JavaScript library designed to simplify the client-side scripting of HTML. jQuery's syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and develop AJAX applications. jQuery also provides capabilities for developers to create plug-ins on top of the JavaScript library to create abstractions for low-level interaction and animation, and high-level, theme-able widgets.	Compatible (see general comment below)
11	PHP	PHP Group ⁶⁹	PHP is a scripting language designed for web development but also used as a general-purpose programming language. PHP code can be simply mixed with HTML code, or it can be used in combination with various templating engines and web frameworks.	Supported
12	Python	Python Software Foundation ⁷⁰	Python is a general-purpose, high-level programming language with a design philosophy emphasising code readability, and syntax that allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management.	Compatible (see general comment below)

⁶⁷ www.ecma-international.org

⁶⁸ www.jquery.org

⁶⁹ www.php.net

⁷⁰ www.python.org

No.	Standard	Source	Description	Flspace Analysis
13	Ruby	Ruby Community ⁷¹	Ruby is a dynamic, reflective, object-oriented, general-purpose programming language. It supports multiple programming paradigms, including functional, object-oriented, and imperative. It also has a dynamic type system and automatic memory management.	Compatible (see general comment below)

Overall the Flspace platform is able to support applications that use the Java programming language and other languages commonly used for web applications (HTML, JavaScript, PHP, etc). Most programming languages are compatible with Flspace provided they include capabilities to utilise a RESTful interface for interacting with the Cloud Service Bus (CSB) of the Flspace platform.

4.5.2 Development Tools

Figure 16 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the development tool standards (i.e. integrated development environments and development frameworks) that were identified.

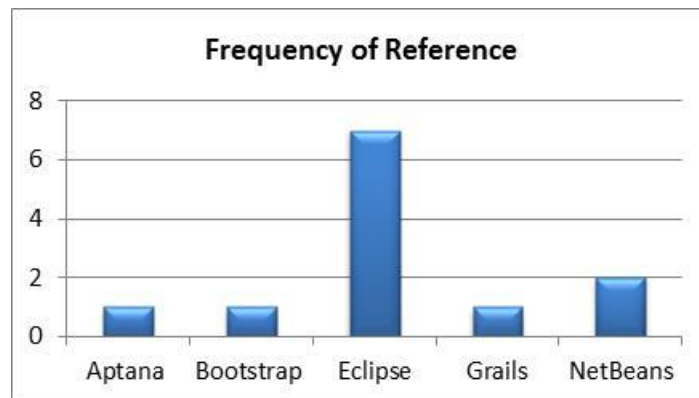


Figure 16: Frequency of reference to development tool standards by Phase III Accelerator providers

A description of the development tools used in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 17.

⁷¹ www.ruby-lang.org

Table 17: Development tool standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	Aptana	Aptana Inc. ⁷²	Aptana Studio is an open source integrated development environment (IDE) for building web applications. Based on Eclipse, it supports JavaScript, HTML, DOM and CSS with code-completion, outlining, JavaScript debugging, error and warning notifications and integrated documentation. Additional plugins allow Aptana Studio to support Ruby on Rails, PHP, Python, Perl, Adobe AIR, Apple iPhone and Nokia WRT (Web Runtime).	Compatible The IDE is based on Eclipse, which is supported by Flspace.
2	Bootstrap	Github ⁷³	Bootstrap is an open-source collection of tools for creating websites and web applications. It contains HTML- and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Bootstrap is a front end, which is an interface between the user and the server-side code which resides on the server.	Compatible The HTML and CSS-based design templates could be used with Flspace.
3	Eclipse	Eclipse Foundation ⁷⁴	Eclipse is an integrated development environment (IDE) that contains a base workspace and an extensible plug-in system for customizing the environment. Originally intended for Java development, by means of various plug-ins, Eclipse may also be used to develop applications in other programming languages. Development environments include the Eclipse Java development tools (JDT) for Java and Scala, Eclipse CDT for C/C++ and Eclipse PDT for PHP, among others.	Supported

⁷² www.aptana.com⁷³ Accessible via www.getbootstrap.com⁷⁴ www.eclipse.org

No.	Standard	Source	Description	Flspace Analysis
4	Grails	OCI ⁷⁵	Grails is an open source web application framework that uses the Groovy programming language (which is in turn based on the Java platform). It is intended to be a high-productivity framework by following the "coding by convention" paradigm, providing a stand-alone development environment and hiding much of the configuration detail from the developer.	Compatible The underlying Java platform for Groovy should allow applications developed using Grails to utilise Flspace features.
5	Netbeans	Netbeans.org ⁷⁶	NetBeans is a software development platform that NetBeans Platform allows applications to be developed from a set of modular software components called modules. NetBeans IDE supports development of all Java application types out of the box, also support for C/C++, and PHP is provided. Among other features are an Ant-based project system, Maven support, refactoring, and version control.	Supported

The use of Eclipse within Flspace provides support for the most popular integrated development environment standard, and other tools have facilities to access the underlying Java platform for implementing features compatible with the Flspace platform.

4.5.3 Remote Services

Figure 17 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the remote services standards that were identified.

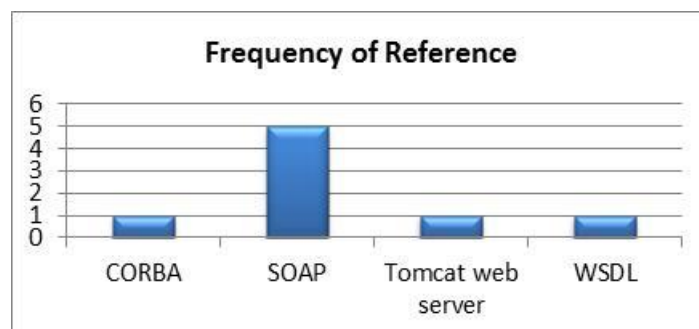


Figure 17: Frequency of reference to remote services standards by Phase III Accelerator providers

A description of the remote services standards used in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 18.

⁷⁵ www.ociweb.com

⁷⁶ www.netbeans.org

Table 18: Remote services standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	CORBA	OMG ⁷⁷	Common Object Request Broker Architecture (CORBA) is designed to facilitate the communication of systems that are deployed on diverse platforms. CORBA enables collaboration between systems on different operating systems, programming languages, and computing hardware and has many of the same design goals as object-oriented programming: encapsulation and reuse.	Compatible (see general comment below)
2	SOAP	W3C ⁷⁸	SOAP (Simple Object Access protocol) is a protocol specification for exchanging structured information in the implementation of web services in computer networks. It uses XML for its message format, and relies on other application layer protocols, most notably Hypertext Transfer Protocol (HTTP) for message negotiation and transmission.	Supported
3	Tomcat web server	Apache ⁷⁹	Apache Tomcat is an open source web server and servlet container developed by the Apache Software Foundation. Tomcat implements several Java specifications including Java Servlet, JavaServer Pages (JSP), Java EL, and WebSocket, and provides a "pure Java" HTTP web server environment for Java code to run in.	Supported
4	WSDL	W3C ⁸⁰	Web Services Description Language (WSDL) is an XML-based interface definition language that is used for describing the functionality offered by a web service. It provides a machine-readable description of how the service can be called, what parameters it expects, and what data structures it returns.	Supported

The WSDL and Tomcat standards are widely used for Web Services based frameworks and are standards used in the implementation of the Flspace platform. The Flspace platform would not prevent the use of CORBA by applications for handling of application specific objects, or accessing legacy / external service, but CORBA is not utilised within the Flspace platform.

⁷⁷ www.omg.org

⁷⁸ www.w3.org

⁷⁹ Accessible via <http://tomcat.apache.org>

⁸⁰ www.w3.org

4.5.4 Data Exchange

Figure 18 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the standards for data exchange that were identified. These generic data format standards are often utilised for constructing domain-specific messaging standards.

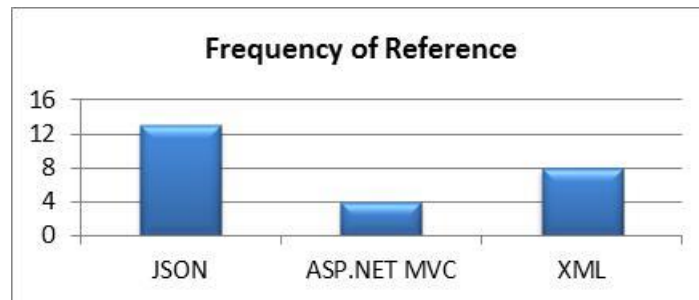


Figure 18: Frequency of reference to data exchange standards by Phase III Accelerator providers

A description of the standards used for data exchange in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 19.

Table 19: Data exchange standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	JSON	ECMA ⁸¹	JavaScript Object Notation (JSON), is an open standard format that uses human-readable text to transmit data objects consisting of attribute–value pairs. It is used primarily to transmit data between a server and web application, as an alternative to XML. JSON is a language-independent data format.	Supported
2	ASP.NET MVC	Microsoft ⁸²	ASP.NET is an open source server-side Web application framework from Microsoft designed for Web development to produce dynamic Web pages. It allows programmers to build dynamic web sites, web applications and web services. ASP.NET MVC is the web application framework that implements the model–view–controller (MVC) pattern.	Not Compatible The ASP.NET standard relies on an underlying .Net environment that is not compatible with Flspace.

⁸¹ www.json.org

⁸² www.asp.net/mvc

No.	Standard	Source	Description	Flspace Analysis
3	XML	W3C	Extensible Markup Language (XML) defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. The design goals of XML emphasize simplicity, generality and usability across the Internet. It is a textual data format with strong support via Unicode for different human languages. Although the design of XML focuses on documents, it is widely used for the representation of arbitrary data structures such as those in web services.	Supported

The Flspace platform supports multiple types of data interchange standards, however the ASP.NET standard relies on an underlying .Net environment being available, which is not compatible with Flspace.

4.5.5 Data Persistence

Figure 19 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the data persistence standards that were identified.

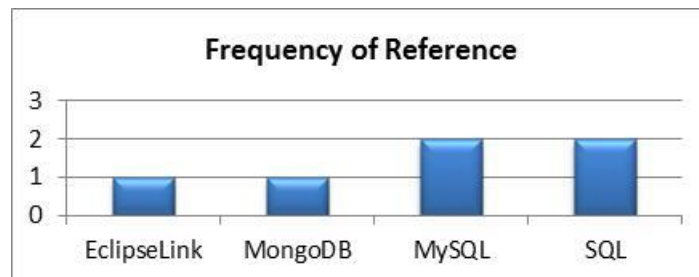


Figure 19: Frequency of reference to data persistence standards by Phase III Accelerator providers

A description of the data persistence standards used in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 20.

Table 20: Data persistence standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	EclipseLink	Eclipse Foundation ⁸³	EclipseLink is the open source Eclipse Persistence Services Project that provides an extensible framework that allows Java developers to interact with various data services, including databases, web services, Object XML mapping (OXM), and Enterprise Information Systems (EIS). EclipseLink supports a number of persistence standards including: Java Persistence API (JPA), Java Architecture for XML Binding (JAXB), Java Connector Architecture (JCA) and Service Data Objects (SDO).	Compatible (see general comment below)
2	MongoDB	MongoDB Community ⁸⁴	MongoDB is a cross-platform open source document-oriented database. Classified as a NoSQL database, MongoDB eschews the traditional table-based relational database structure in favour of JSON-like documents with dynamic schemas, making the integration of data in certain types of applications easier and faster.	Compatible (see general comment below)
3	MySQL	Oracle Corp. ⁸⁵	MySQL is a widely used relational database management system (RDBMS) and is a popular choice of database for use in web applications. Free open source projects that require a full-featured database management system often use MySQL.	Compatible (see general comment below)
4	SQL	ISO ⁸⁶	Structured Query Language (SQL) is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). Originally based upon relational algebra and tuple relational calculus, SQL consists of a data definition language and a data manipulation language. The scope of SQL includes data insert, query, update and delete, schema creation and modification, and data access control.	Compatible (see general comment below)

⁸³ www.eclipse.org
⁸⁴ www.mongodb.org
⁸⁵ www.mysql.com
⁸⁶ www.iso.org

In general, the Flspace platform does not store application specific data so the choice of data persistence standards is a technology decision that can be taken by application developers largely independent of the Flspace platform.

4.6 Security Standards

Figure 20 indicates the frequency of reference amongst the Phase III Accelerator application providers for each of the security standards that were identified.

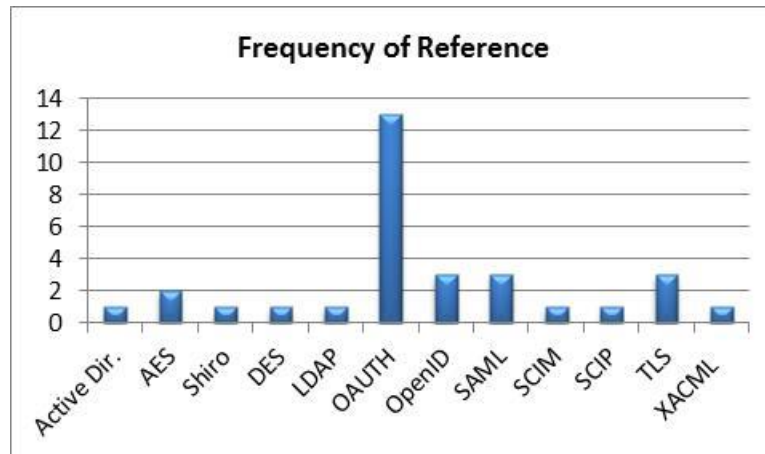


Figure 20: Frequency of reference to security standards by Phase III Accelerator providers

A description of the security standards used in supply chain applications that have been identified by Phase III Accelerator application providers and an analysis of the capabilities of the Flspace platform to support the identified standards is provided in Table 21.

Table 21: Security standards used by Phase III Accelerator providers

No.	Standard	Source	Description	Flspace Analysis
1	Active Directory	Microsoft ⁸⁷	Active Directory (AD) is a directory service that Microsoft developed for Windows domain networks and is included in most Windows Server operating systems. An AD domain controller authenticates and authorises all users and computers in a Windows domain type network—assigning and enforcing security policies for all computers and installing or updating software. Active Directory makes use of Lightweight Directory Access Protocol (LDAP).	Not Compatible Flspace provides a Web services based security framework.
2	AES	NIST ⁸⁸	Advanced Encryption Standard (AES), is a symmetric block cipher for data encryption. It was introduced as a new standard to replace DES (see below) with stronger encryption properties.	Supported

⁸⁷ Accessible via <http://msdn.microsoft.com/en-us/library/bb742424.aspx>

⁸⁸ www.nist.gov

No.	Standard	Source	Description	Flspace Analysis
3	Shiro	Apache ⁸⁹	Apache Shiro is an open source software Java security framework that performs authentication, authorization, cryptography and session management. Shiro has been designed to be an intuitive and easy-to-use framework while still providing robust security features.	Not Compatible Flspace utilises an alternative security framework.
4	DES	NIST	Data Encryption Standard (DES) is an older symmetric block cipher for data encryption using a relatively small 56-bit key which is vulnerable to brute force attacks. DES was designed primarily for hardware and is relatively slow when implemented in software.	Compatible (see general comment below)
5	LDAP	IETF ⁹⁰	Lightweight Directory Access Protocol (LDAP) is an open, vendor-neutral, application protocol for accessing and maintaining distributed directory information services over an Internet Protocol (IP) network. Directory services allow sharing of information about users, systems, networks, services, and applications throughout the network.	Supported
6	OAUTH	IETF	OAuth is an open standard for authorisation that provides client applications a 'secure delegated access' to server resources on behalf of a resource owner. It specifies a process for resource owners to authorise third-party access to their server resources without sharing their credentials. Designed specifically to work with Hypertext Transfer Protocol (HTTP), OAuth essentially allows access tokens to be issued to third-party clients by an authorisation server, with the approval of the resource owner, or end-user.	Supported

⁸⁹ Accessible via <http://shiro.apache.org>

⁹⁰ www.ietf.org

No.	Standard	Source	Description	Flspace Analysis
7	OpenID	OpenID Foundation ⁹¹	OpenID allows users to be authenticated by certain co-operating sites (known as Relying Parties) using a third party service, eliminating the need for webmasters to provide their own ad hoc systems and allowing users to consolidate their digital identities. Users may create accounts with their preferred OpenID identity providers, and then use those accounts as the basis for signing on to any website which accepts OpenID authentication. The OpenID protocol does not rely on a central authority to authenticate a user's identity.	Supported
8	SAML	OASIS	Security Assertion Markup Language (SAML) is an XML-based data format for exchanging authentication and authorization data between parties, in particular, between an identity provider and a service provider. SAML primarily addresses the web browser single sign-on (SSO) challenge.	Supported
9	SCIM	IETF	System for Cross-domain Identity Management (SCIM) is a standard for automating the exchange of user identity information between identity domains, or IT systems. In addition to simple user-record management (creating & deleting), SCIM can also be used to share information about user attributes, attribute schema, and group membership.	Not Compatible Flspace utilises an alternative security framework.
10	SCIP	NSA ⁹²	Secure Communications Interoperability Protocol (SCIP) is a multinational standard for secure voice and data communication. SCIP derived from the US Government Future Narrowband Digital Terminal (FNBDT) project after the US offered to share details with other nations in 2003. SCIP supports a number of different modes, including national and multinational modes which employ different cryptography. Many nations and industries develop SCIP devices to support the multinational and national modes of SCIP.	Not Compatible These types of secure communications largely for government systems are outside the scope of the secure B2B collaborations targeted by Flspace.

⁹¹ www.openid.net

⁹² www.nsa.gov

No.	Standard	Source	Description	Flspace Analysis
11	TLS	IETF	Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols designed to provide communications security over a computer network. They use X.509 certificates and asymmetric cryptography to authenticate the counterparty with whom they are communicating, and to negotiate a symmetric key. This session key is then used to encrypt data flowing between the parties. This allows for data/message confidentiality and message authentication codes for message integrity and as a by-product, message authentication.	Supported
12	XACML	OASIS	eXtensible Access Control Markup Language (XACML) defines a declarative access control policy language implemented in XML and a processing model describing how to evaluate authorization requests according to the rules defined in policies. One of the goals of XACML is to promote common terminology and interoperability between authorisation implementations by multiple vendors.	Not Compatible Flspace utilises an alternative security framework.

The Flspace platform utilises TLS, OAUTH and KeyCloak for implementing security features. KeyCloak is built using SAML and OpenID so these standards are supported. Shiro, SCIM and XACML are not compatible with the KeyCloak implementation used for Flspace. Active Directory is not compatible with the Web services approach utilised by Flspace. Older encryption mechanisms such as DES can be utilised by application developers, but are not part of the Flspace platform. The type of secure communications addressed by SCIP for government systems are outside the scope of the B2B collaborative communications targeted by Flspace.

5 Summary

5.1 Overall assessment

The analyses undertaken by the Task 540 partners to validate Flspace support for required standards originating from other standardisation organisations and relevant networks has shown that the Flspace platform either supports or is compatible with nearly all of the standards identified by the application developers from the Open Call partners and the funded Phase III Accelerator providers.

A total of 105 unique standards were identified for use in development of applications targeting the Flspace platform and of these, 11 were evaluated as not compatible with the Flspace platform. Of those evaluated as not compatible, the primary reason was either reliance on technologies closely aligned with a specific platform (e.g. Microsoft) or similar features had been implemented in Flspace using an alternative standard that was more widely accepted and deployed in industry.

The overall design principles and the technology choices made in developing the Flspace platform have resulted in an open platform with broad support for industry standards.

5.2 Recommendations

In consideration of the analysis and validation that was carried out, the Task 540 partners have identified the following recommendations:

- It would be helpful to provide additional documentation with guidance to application developers who currently utilise Microsoft's .Net framework concerning the steps needed to transition to use the Flspace platform and underlying architecture.
- Some guidance on using widgets and other Flspace features for applications written in languages other than Java (e.g. R, Ruby, etc.) would be helpful for a subset of applications developers targeting the Flspace platform.

These recommendations target a relatively small subset of the application developers that would be motivated to exploit the Flspace platform for new business applications, but would further expand the likely adoption of Flspace as an important B2B collaboration environment for industry.

Looking forward towards deployment of the Flspace platform, it's worth noting that typically the higher the number of overlapping standards that are supported, the higher the effort required to maintain interoperability of systems. It is therefore recommended that consideration be given as to whether measures should be taken to guide application developers towards a more focused and lower number of overlapping standards, which would likely reduce the support costs of maintaining the Flspace platform when commercially deployed.

