



MUlti-cloud Secure Applications

The MUSA Framework

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Presentation Outline

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MUSA project, objectives, challenges and baseline

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MUSA Initial steps

1 MUSA project

- EU H2020-ICT-2015. Advanced Cloud Infrastructures and Services.
- MUSA H2020 project aims at contributing to building up the innovation capacity and technology excellence of the European software and service industry, particularly Cloud services.
- Start date: 1st Jan 2015
- Duration: 36 months.
- Coordinator: Erkuden Rios, Tecnalia (Spain).

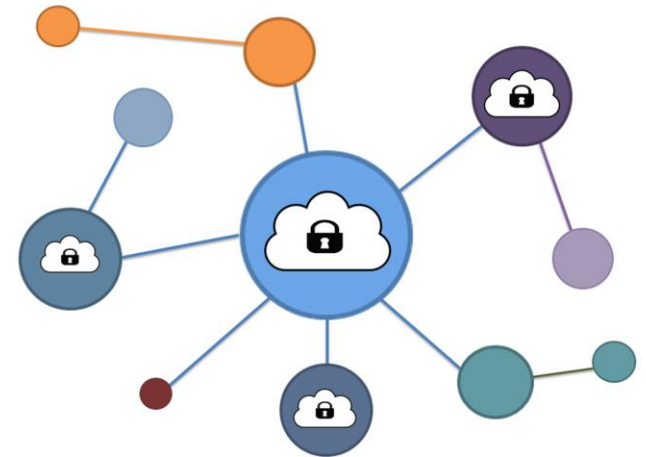
MUSA consortium



Objectives

- **The MUSA Framework** is the future main result of MUSA project – **embed security in the lifecycle of multi-cloud apps for self protection.**

Multi-cloud application: distributed application over heterogeneous cloud resources. Its components are deployed in different cloud service providers and work in an integrated way and transparently for the end-user.



- Multi-cloud applications have to deal with the **security of the individual components & overall application security** including the communications and the data flow between the components.

Challenges

- Enable the **security aware design** of distributed applications over heterogeneous cloud services.
- **Automatic discovery** of the cloud services that match with the application security requirements as well as functional and business needs.
- **Decision support** to **select the combinations** of cloud services that **best match** the required balance between security and functional properties.
- Automated **distributed deployment** of the components.
- Security assurance through **continuous monitoring** of components and CSP behaviour.
- **Integrated methods** in both engineering and operation of multi-cloud applications.

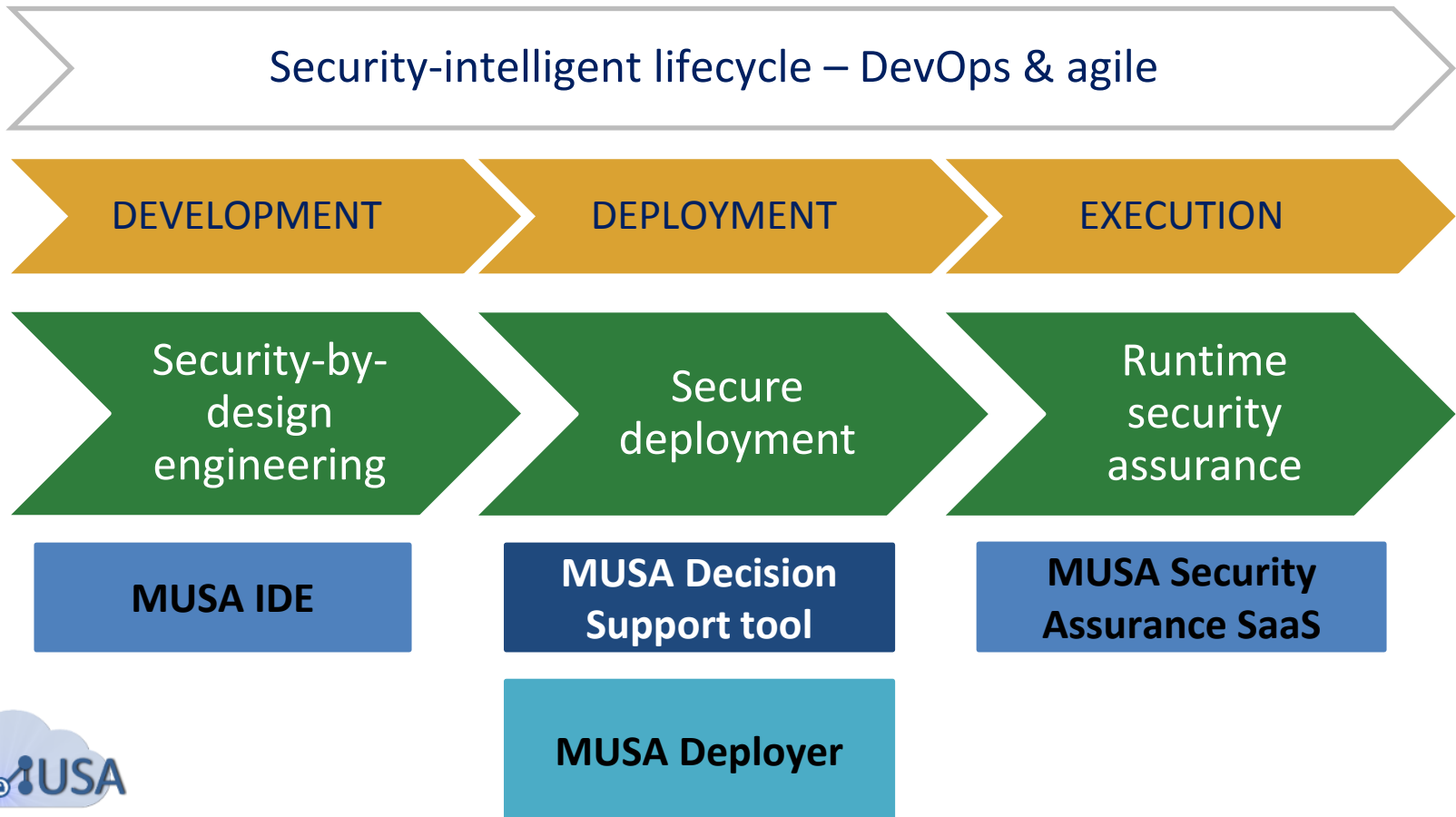


Baseline

- Security-by-design in multi-cloud apps
 - SbD (Kreizman & Robertson), RASP (Gartner), etc.
 - Security Control frameworks: NIST Control Framework, and the ISO/IEC 27001.
 - Cloud security control frameworks: NIST SP500, Cloud Data Protection Cert, Cloud Security Alliance CCM.
- Security aware SLAs in multi-cloud apps
 - Open Grid Forum's WS-Agreement, IBM's WSLA, etc.
 - EU projects towards SecSLA: SPECS, A4Cloud, CUMULUS, etc.
- Security driven dynamic Deployment of multi-cloud apps
 - CloudML: variants in ModaClouds, PaaSage, ARTIST EU projects.
 - OASIS's TOSCA.

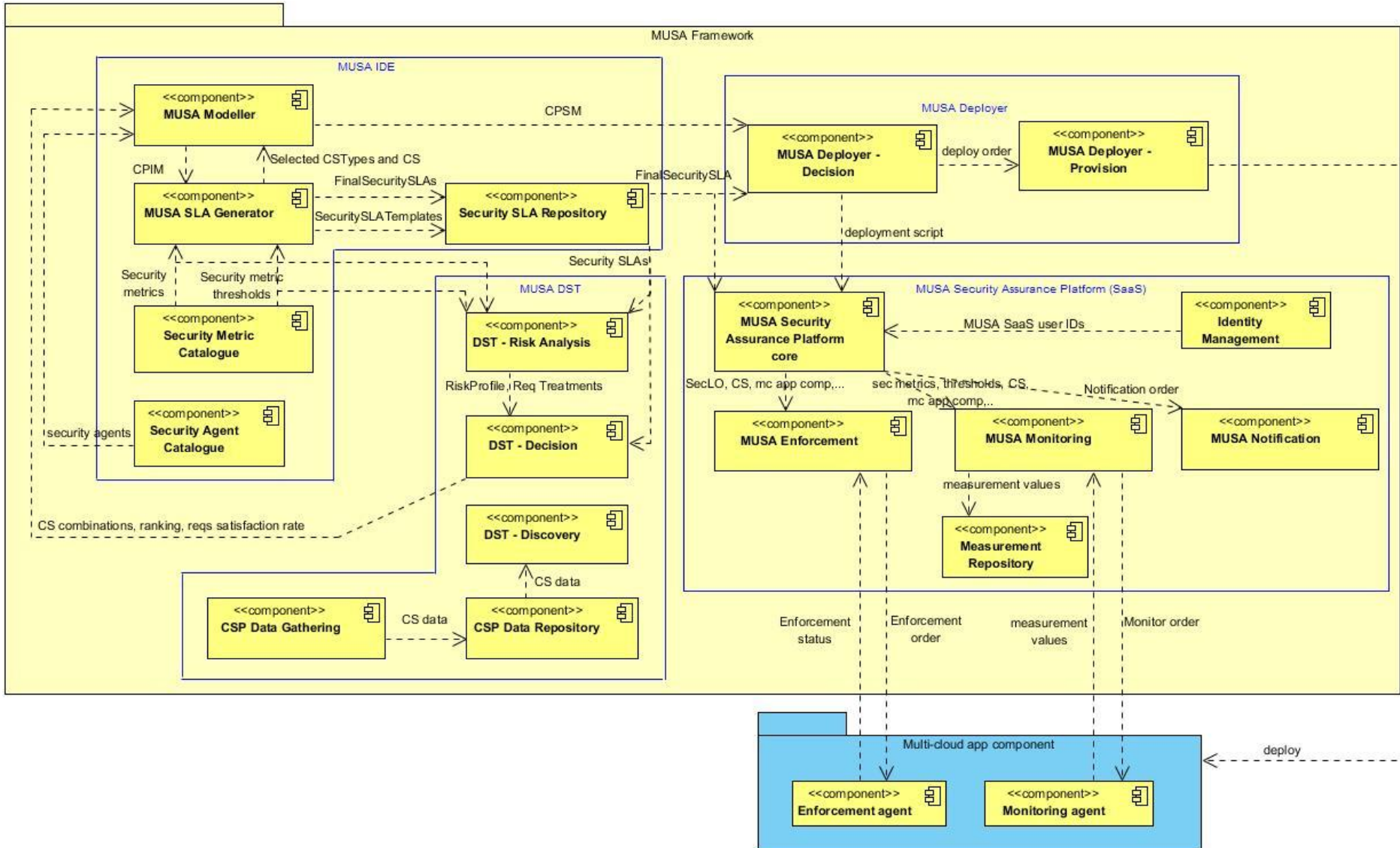
2 The MUSA Framework

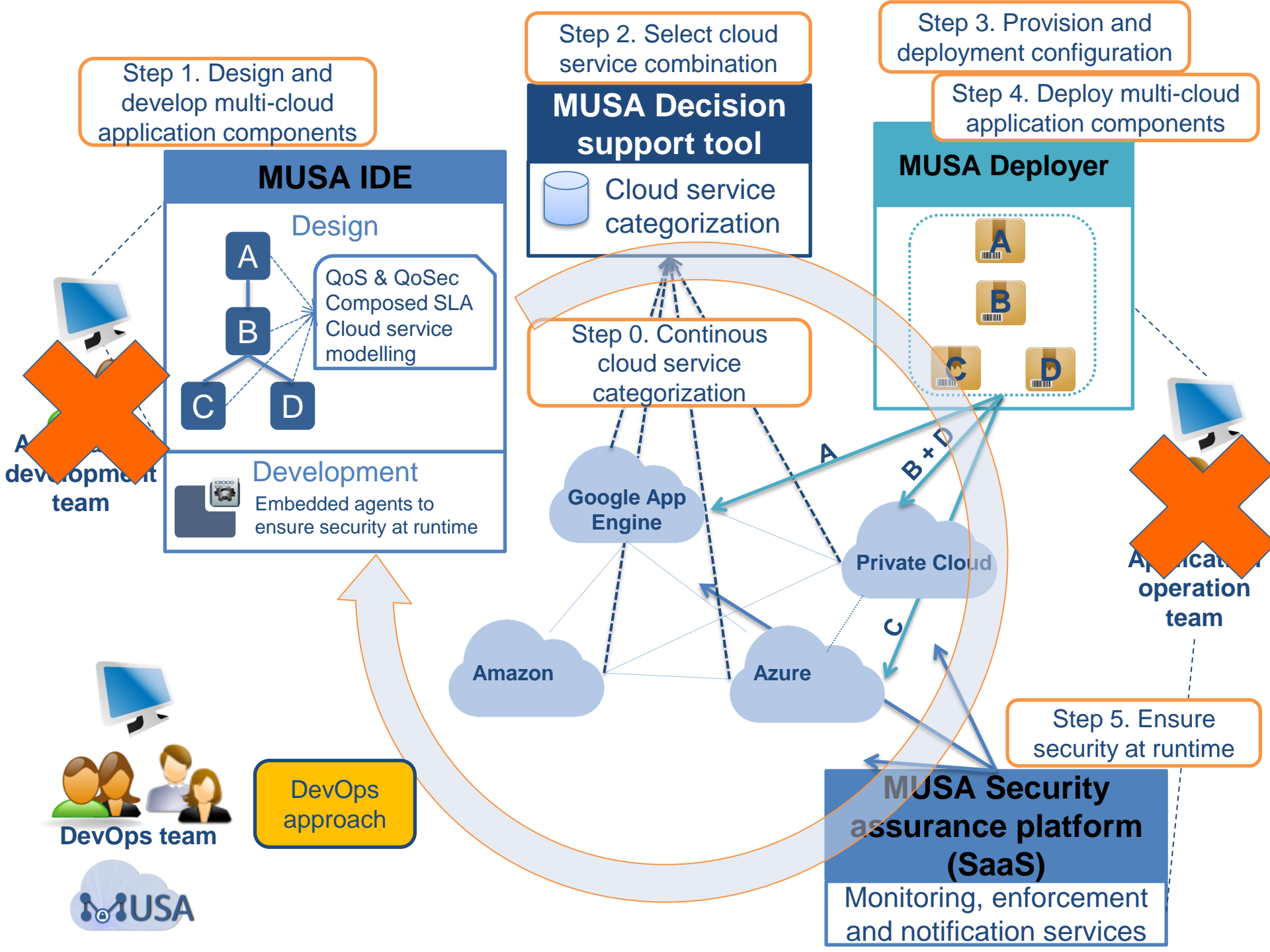
- MUSA Framework – a holistic framework to support the security-intelligent lifecycle management of multi-cloud applications



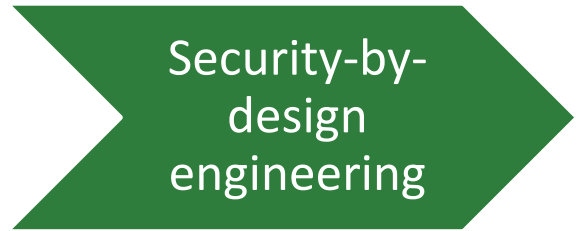
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The MUSA Framework





Development support



MUSA IDE

Integrated Development Environment – includes:

MUSA Modeller

Creation of the multi-cloud application specification model (in CloudML language), in different levels of abstraction: CPIM (Cloud Provider Independent Model) and CPSM (Cloud Provider Specific Model).

MUSA SLA Generator

Creation of the multi-cloud application **Security SLA** including automatic generation of SLA from the multi-cloud application model and interpretation of the results of the risk analysis performed by the DST.



Repository that stores the **list of metrics (and their definition)** that can be included in a Security SLA.

Security Metric Catalogue

Deployment support

Secure
deployment



CSP Data Repository

Cloud service categorization of CSPs based on announced security and functional properties and the measures of the properties at execution.

MUSA Decision
support tool

Selection of the cloud services which combination is compliant with the security and functional requirements specified in the multi-cloud application composite SLA, after a previous simplified process of **risk analysis**.

MUSA Deployer

Automated deployment of the multi-cloud secure application, distributing each of the application components' packages towards the matched cloud service.



Runtime support



Runtime
security
assurance

**MUSA Security
Assurance Platform
(SaaS)**

Multi-cloud application contract (SLA) verification through runtime assessment supported by complex processing of composed measures of low-level metrics.

Three main services:

- **Monitoring** capable of collecting security properties using standard APIs, cloud interoperability frameworks, or measures by MUSA security embedded agents.
- **Notification** to the application provider (DevOps team) about detected security relevant incidents.
- **Enforcement** to ensure that the multi-cloud application respects the security requirements in its SLA.



Security assurance as a service

MUSA Security Assurance Platform



- Security SLA Repository



- Monitoring (server side)



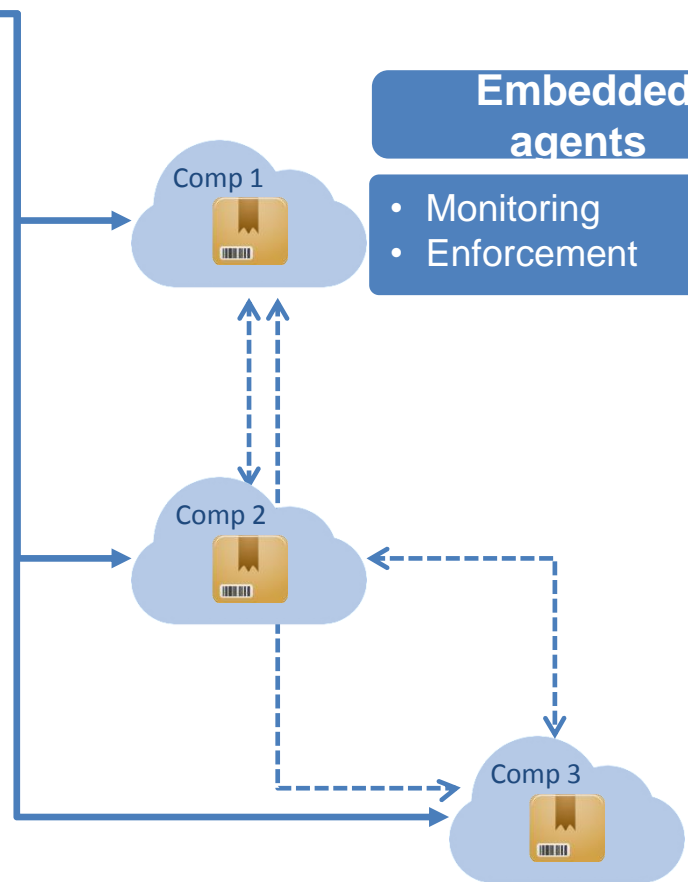
- Notification (server side)



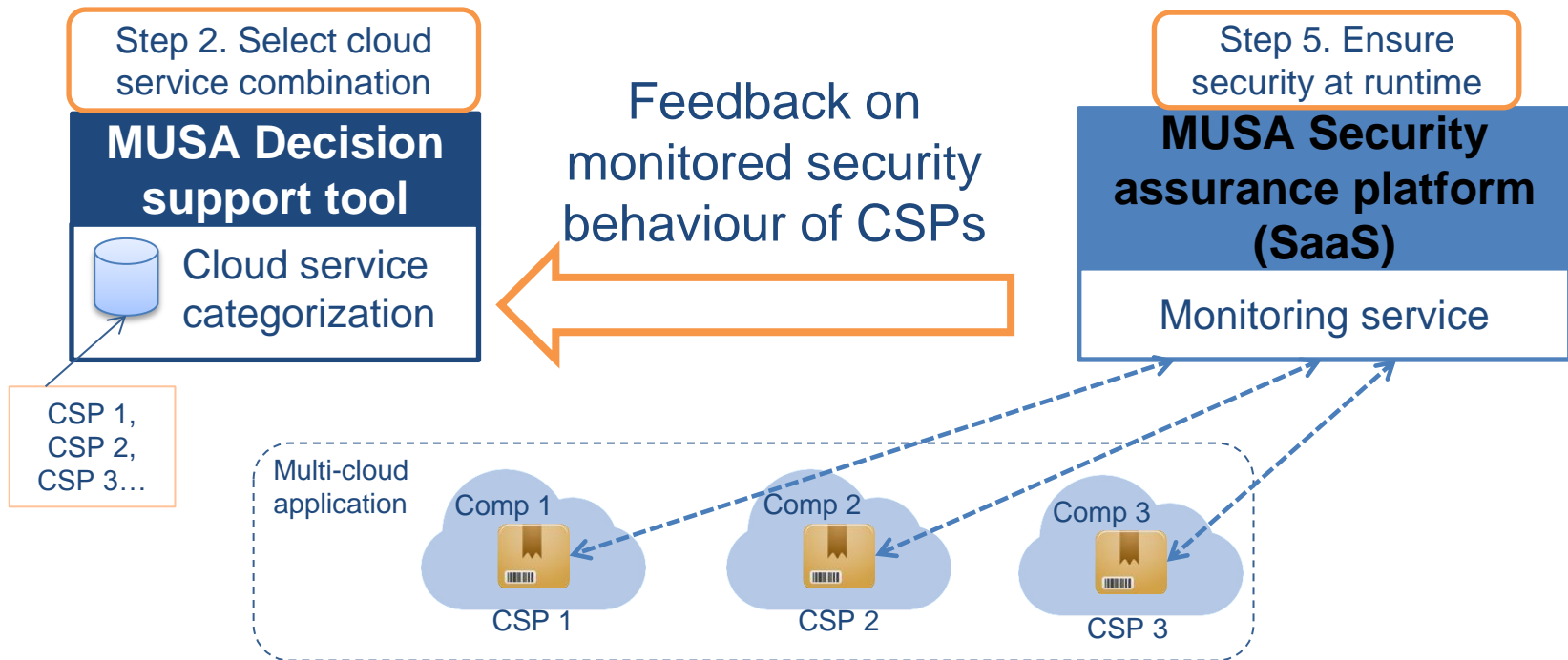
- Enforcement (server side)

Embedded agents

- Monitoring
- Enforcement



Runtime security monitoring



3 Framework validation

Airline Flight Scheduling multi-cloud application

- NetLine/Sched product by Lufthansa Systems
- data localisation, data retention and deletion, data integrity, confidentiality, access control, etc.



Smart Mobility multi-cloud application



- energy efficient and sustainable multi-modal transit of Tampere citizens when commuting from home to work and vice versa.
- based on services exposed in *Intelligent Transport Systems and Services (ITS) platform* (<http://wiki.itsfactory.fi>)
- confidentiality and privacy of citizens personal data and location.

4 MUSA Initial steps

- MUSA has achieved its Milestone 2 (Dec 2015):
 - Initial architecture of MUSA Framework,
 - Case studies plan
 - Business scenarios analysis.
- First validation in the pilots will take place on Dec 2016.
- We coordinate the Cluster on EU funded research projects on Data Protection, Security and Privacy in the Cloud. Supported by EC's DG-CNET.

<https://eucloudclusters.wordpress.com/>



A 3D rendering of red, rectangular blocks with white text. The top row contains five blocks spelling 'THANK' and the bottom row contains three blocks spelling 'YOU'. The blocks are arranged on a white surface with a slight reflection below them.

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MUSA project (Group)



MUSA Project



