MUlti-cloud Secure Applications

The MUSA Framework

Erkuden Rios, TECNALIA ICT Division (Spain)
Presentation Outline

1. MUSA project, objectives, challenges and baseline
2. MUSA Framework overview
3. MUSA Framework validation
4. MUSA Initial steps
MUSA project

- 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: 1\textsuperscript{st} 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.
  - 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.
The MUSA Framework

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

Security-intelligent lifecycle – DevOps & agile

- Development:
  - Security-by-design engineering
  - MUSA IDE

- Deployment:
  - Secure deployment
  - MUSA Decision Support tool

- Execution:
  - Runtime security assurance
  - MUSA Security Assurance SaaS
  - MUSA Deployer
The MUSA Framework
Basic cloud service categorization

**Step 0. Continuous cloud service categorization**

**Step 1. Design and develop multi-cloud application components**

**MUSA IDE**
- QoS & QoSec
- Composed SLA
- Cloud service modelling

**Step 2. Select cloud service combination**

**MUSA Decision support tool**
- Cloud service categorization

**Step 3. Provision and deployment configuration**

**MUSA Deployer**
- MUSA Security assurance platform (SaaS)
- Monitoring, enforcement and notification services

**Step 4. Deploy multi-cloud application components**

**Step 5. Ensure security at runtime**

**DevOps approach**

- Embedded agents to ensure security at runtime

**Application development team**

**Application operation team**

**MUSA Security tool**
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

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

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.

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

Comp 1

Comp 2

Comp 3
Runtime security monitoring

Step 2. Select cloud service combination

MUSA Decision support tool

Cloud service categorization

CSP 1, CSP 2, CSP 3...

Step 5. Ensure security at runtime

Feedback on monitored security behaviour of CSPs

MUSA Security assurance platform (SaaS)

Monitoring service

Multi-cloud application

Comp 1, Comp 2, Comp 3

CSP 1, CSP 2, CSP 3...
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.
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.

[Link](https://eucloudclusters.wordpress.com/)
Erkuden Rios
MUSA Project Coordinator
TECNALIA
ICT – European Software Institute Division
erkuden.rios@tecnalia.com

www.musa-project.eu
@MUSA_project
MUSA project (Group)
MUSA Project