OSMOSE: A Paradigm for the Liquid-Sensing Enterprise

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Overview

- OSMOSE Project Motivation
- OSMOSE Basic Concepts
- OSMOSE Architecture
- Applications
- Conclusion and Future Work
Project Motivation

According to the FInES Research Roadmap 2025, **Sensing Enterprise** and **Liquid Enterprise** are two Qualities of Being which are considered strategic for any future enterprise.

- The **Sensing Enterprise** will emerge with the evolution of the Internet of Things, when objects, equipment, and technological infrastructures will exhibit advanced networking and processing capabilities, actively cooperating to form a sort of 'nervous system' within the enterprise next generation.

- The **Liquid Enterprise** is an enterprise having fuzzy boundaries, in terms of human resources, markets, products and processes. Its strategies and operational models will make it difficult to distinguish the *inside* and the *outside*. 

27/5/2015
Klaus Fischer @ IWEI 2015, Nimes
The **Sensing-Liquid Enterprise** as a pot internally subdivided into three sectors by means of three membranes and forming the **Real-Digital-Virtual** sectors.

- A blue liquid is poured into the first sector → **Real World population**
- A red liquid into the second sector → **Digital World population**
- A green liquid into the third sector → **Virtual World population**

If the membranes are **semi-permeable**, by following the rules of osmosis which characterises each of the three membranes, the liquid particles could pass through them and influence the neighbouring world, so that in reality in the blue **Real World** we could also have red-green shadow ambassadors of the **Digital/Virtual** World and similarly for the other Worlds.
Liquid-Sensing Enterprise Physics Metaphor

Real World Population

Digital World Population

Virtual World Population

Impermeable membrane

Semi-permeable membrane

Semi-permeable membrane

Semi-permeable membrane
Project Mission

Develop a reference architecture, a middleware, and prototypal applications for the Sensing-Liquid Enterprise, by interconnecting Real, Digital and Virtual worlds in the same way a semi-permeable membrane permits the flow of liquid particles through itself.
Overall OSMOSE Architecture

Physical sensors, actuators, devices and objects

Digital datasets, metadata, models and multimedia

Inter-World Communication, Background Consistency, Privacy & Security

Virtual 2D/3D AR/VR Models, Simulation Environments
OSMOSE Metamodel

Real World KB

Digital World KB

Common KB

Entity KB

Process KB

Event KB

Service KB

Virtual World KB

Digitalization

Actuation

Augmentation

Virtualization

Enrichment

Simulation
OSMOSE Middleware Architecture

INTER-WORLD ROUTER

MEMBRANE BUS

DATA ACCESS GATEWAY

CONTEXT MANAGER

OSMOSIS MANAGER

SERVICE MANAGER

EVENT MANAGER
Introducing the Aeronautics Scenario

Flight Simulation (@AW)

- Flight Simulators are intended as training device letting pilots to perform several types of training in different flight scenario. The most important feature of these devices is the possibility to reproduce system malfunction and emergency scenario that cannot be done on the real aircraft.

- Flight simulators are used by end-Customers with a contractual commitment that requires an extremely high availability (close to 24/7), which can be provided only if all the logistic chain and support personnel are correctly “synchronised”
Recognition, Generation and Management of Osmiomatic Events
Camshaft Manufacturing (@EPC)

- Camshaft consists of a **cylindrical rod** running the length of the cylinder bank of an **engine** with a number of **oblong lobes** protruding from it, one for each valve. The cam lobes force the valves open by pressing on the valve, or on some intermediate mechanism as they rotate.

- Apart of providing camshafts for the transport sector, EPC is specialized in the niche of big camshafts, **more than 2m long**,
Conclusion and Future Work

• Results
  – Framework based on the osmosis metaphor
  – OSMOSE middleware architecture
  – Two use case scenarios

• Future Work
  – Finalization of the implementation of the architecture
  – Functional and non-functional evaluation and testing
  – Deployment of architectures in the use cases
Questions?

Thank you very much for your attention