

The symbloTe Solution for Cross-Domain and Cross-Platform Interoperability



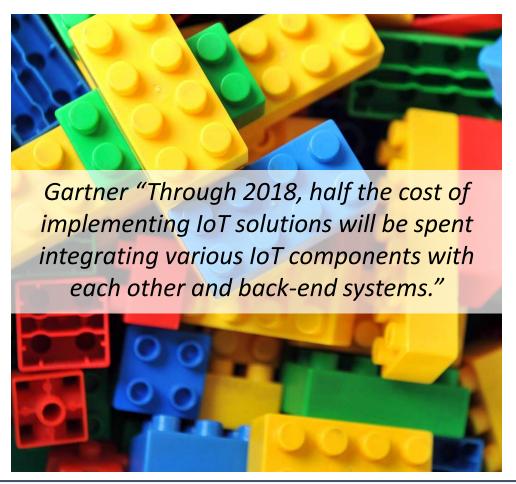
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Reality check



- No. of installed IoT devices worldwide in 2020: 30 billion (source: Statista)
- Cloud-based IoT platforms are predominant
- The lack of interoperable ecosystems
- Existing infrastructure is underutilized
- Users are faced with a multitude of applications within a single domain at various locations







User needs?





Virtual assistant: an intelligent OS

Source: http://www.imdb.com/title/tt1798709/



Minority Report's gesture-based user interface

Source: https://www.imdb.com/title/tt0181689/





European Commission



The implementation of cross-platform and cross-domain IoT applications is today cumbersome and requires customized solutions tailored to the involved platforms and infrastructure, due to their semantic and syntactic incompatibilities.

We require dynamic and replicable applications interacting with different platforms and infrastructure.





symbloTe project







symbiote |sim-bee-oht] noun, biology

an organism living in a state of symbiosis

symbloTe: Symbiosis of smart objects across IoT environments H2020 RIA (2016 - 2018)



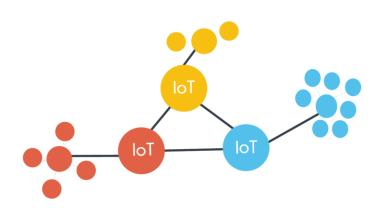


symbloTe offerings

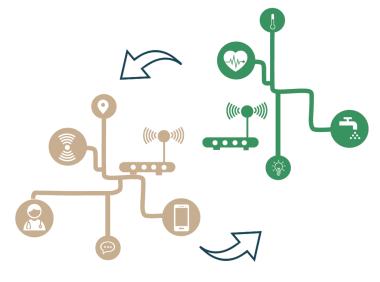




Interoperability for cloud-based platforms



Platform federations



Dynamic smart spaces

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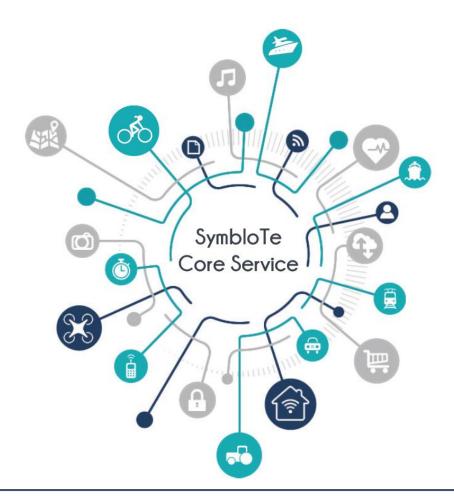




Interoperability for cloud-based platforms



- symbloTe middleware includes
 - software adaptor for IoT platforms
 - IoT portal and search engine (Core Services)
 - library for applications
- Functional offerings
 - unique identifier for exposed resources
 - semantic interoperability
 - security: attribute-based access control



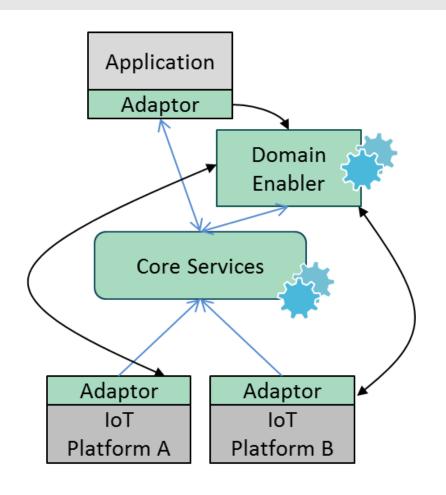




IoT portal & semantic search engine



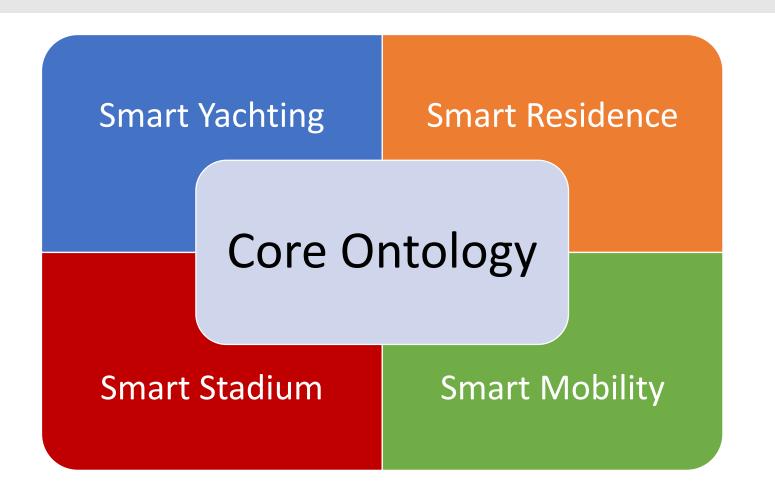
- simplifies app development across different IoT platforms
- IoT platforms offer access to resources (sensors, actuators, services) through a unified REST-based interface
- IoT portal with Core services: registry and semantic search engine for offered resources
- Domain Enabler: value-added services on top of offered resources, simplifies interactions with various platforms





Semantic interoperability (cross-domain)





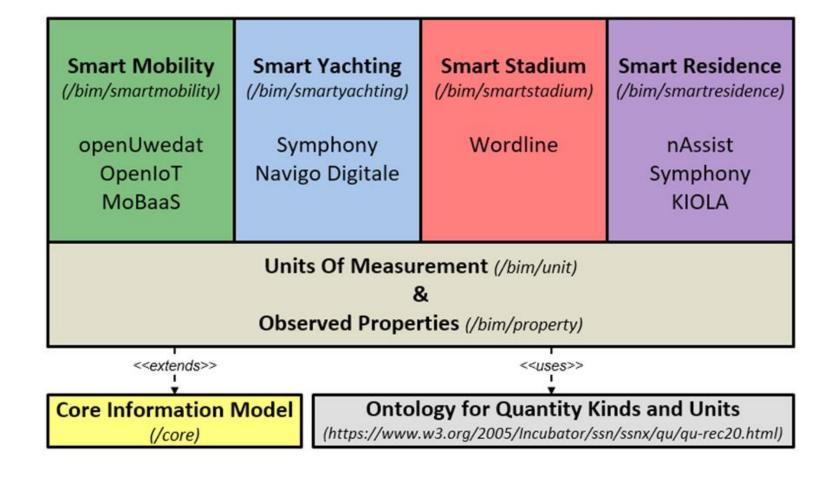
Core Ontology

- core concepts (Sensors, Actuator, Services, and Location),
- re-uses concepts defined by the Sensor-Observation-Sample-Actuator (SOSA) ontology, Actuation-Actuator-Effect ontology pattern and the SensorThings API



symbloTe information models



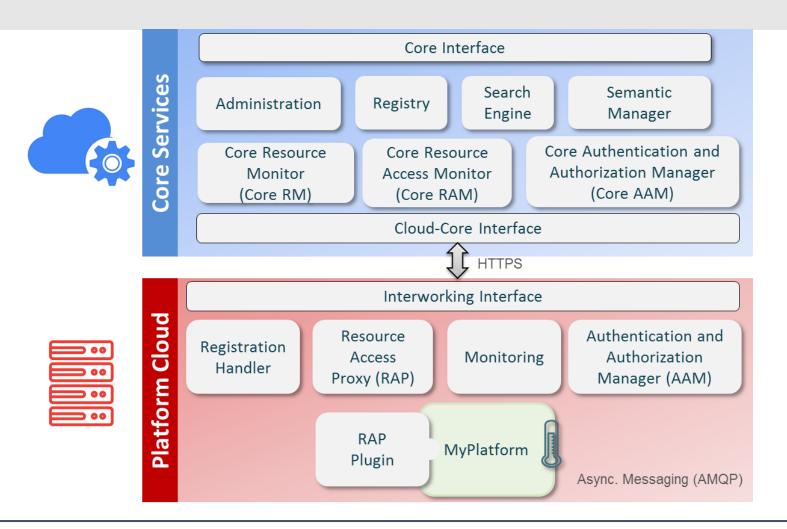




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Building blocks





Microservices running at e.g. https://symbiote-open.man.poznan.pl/

Microservices running on the platform's side (only the RAP Plugin in platform specific)

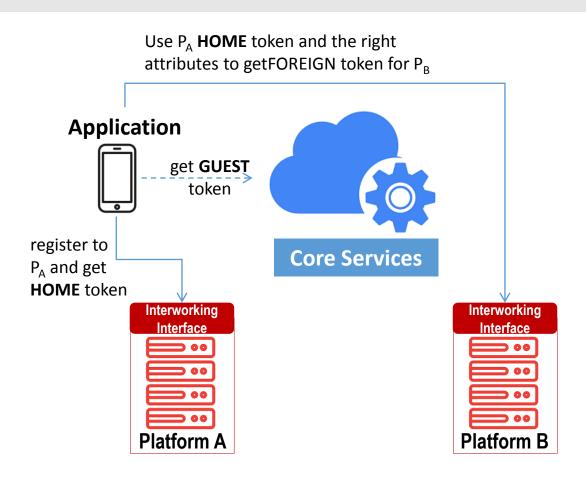
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Security aspects





Decoupled Authentication and Authorization

- PKI certificates trust chaining architecture
- Attributes distributed in standardized trusted data structures: JSON Web Tokens (JWT)

Core Services

- Administration of platforms
- Platform and user *authentication*
- Management of symbloTe components and platforms' CA X.509 certificates

Platform Cloud

Resources protected using the Attribute-Based Access Control (ABAC) paradigm

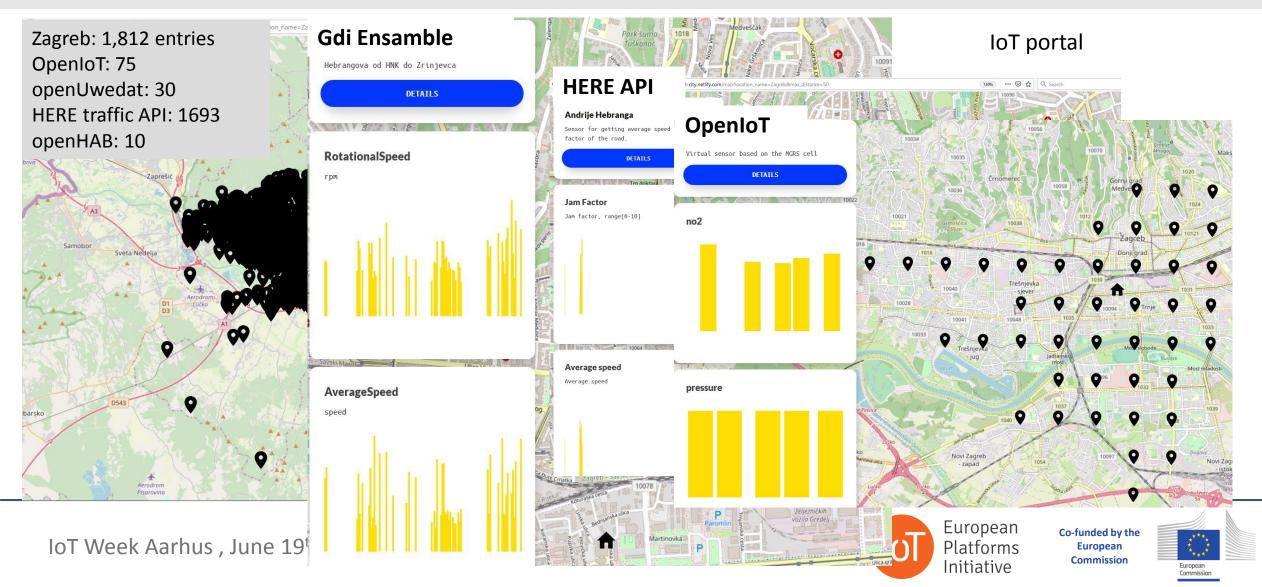
- Access Policy assigned to each resource
- Management of local certificates
- Management of local actor attributes and attribute mapping functions





Cross-domain resources in Zagreb

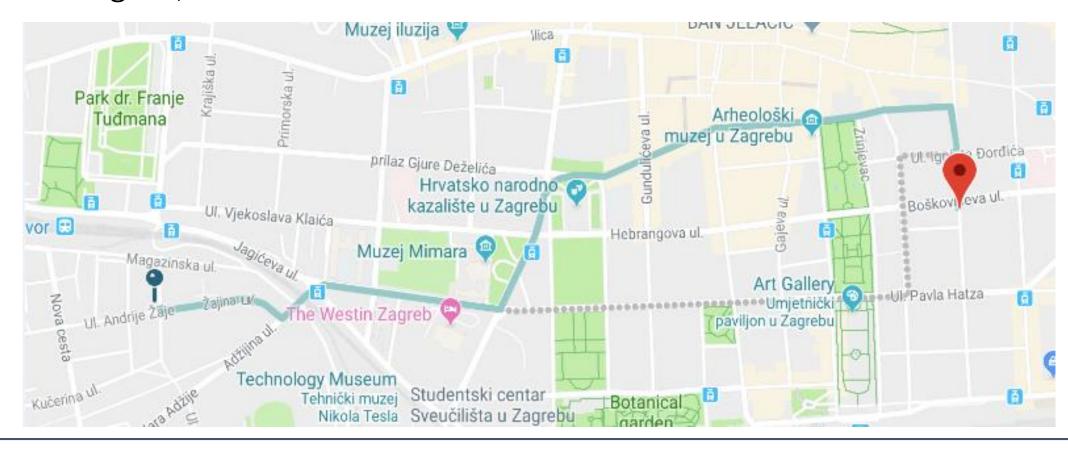




Green routes for cyclists and pedestrians



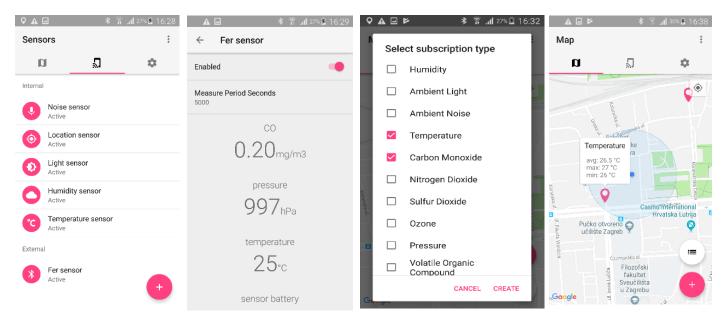
Tested in Zagreb, Vienna and Porto





Crowdsensing App









Google Play / CUPUS Crowdsensing

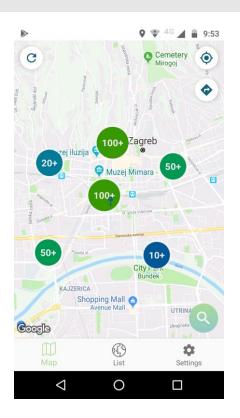


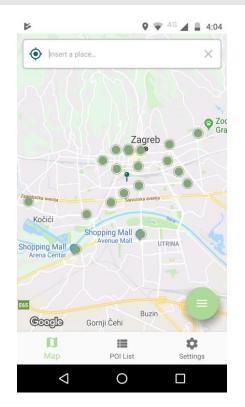


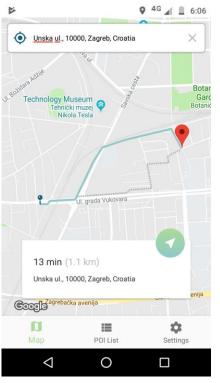
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symbloTe SMEUR Green Routing App









Correlate air quality with traffic (jam factor) and current weather conditions to complement MCS Deployment in another city?









symbloTe middleware





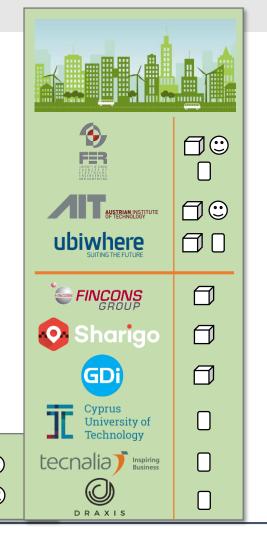
visit https://middleware.symbiote-h2020.eu for more information

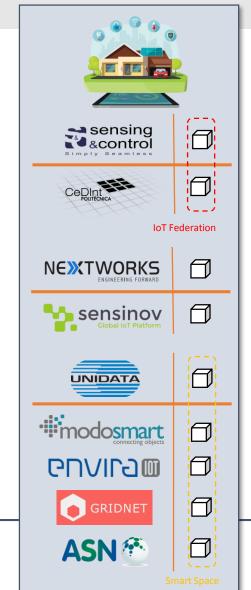


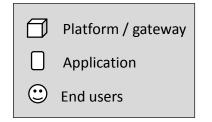


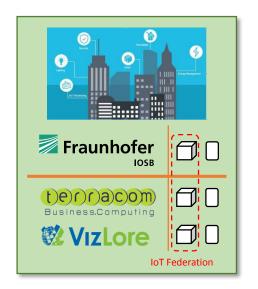
symbloTe ecosystem

















60 60 60

MonitarSense

Ecosystem KPIs



1 open centralized: ~4000 resources, 2 federations ~350 resources



20+

~150

13









symbloTe ecosystems

symbloTe-compliant platforms

symbloTe-compliant gateways/devices

symbloTe apps

value-added services

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symbloTe consortium





- 15 partners
- SMEs w/ IoT solutions
- research institutes
- universities
- large companies

use cases:

- smart residence
- smart campus
- smart mobility
- smart yachting
- smart stadium





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Further information







https://middleware.symbioteh2020.eu



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github.com/symbiote-h2020





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