



RAINBOW NEWSLETTER

ISSUE 2, NOVEMBER 2020

RAINBOW is a Research and Innovation Action funder under the EU Horizon 2020 framework programme, focusing on producing an open, trusted fog computing platform facilitating the deployment, orchestration and management of scalable, heterogeneous and secure IoT services and cross-cloud apps.

RESEARCH CHALLENGES

RAINBOW's research offering consists of a distinct set of tangible technical outcomes that will advance the state-of-the-art in the respective areas:

- **Cloud-service Modelling Language** for fog/edge applications
- **Orchestration Algorithms** to perform proper enactment at the orchestration level during runtime utilizing **heuristic/pruning techniques**
- Efficient **Data Storage, Querying and Processing** pipeline
- **Secure Zero-touch Configuration** of fog nodes with emphasis on **zero-knowledge/collision-free identity acquisition in a mesh environment**
- **Trust Enablers** that relate to Configuration Integrity Verification and Remote Attestation of fog applications



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871403

PROJECT INFORMATION

TITLE: RAINBOW - *A fog platform for secured IoT services*
GRANT AGREEMENT NO: 871403
CALL ID: ICT-15-2019-2020
CALL TOPIC: Cloud Computing
START DATE: January 1st, 2020
END DATE: December 31st, 2022
COORDINATOR: UBITECH
Ubiquitous Solutions

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Look for our hashtags!

#RAINBOW_H2020
#FogComputing
#EdgeComputing
#Industry4
#secureIoT



<https://rainbow-h2020.eu>

TECHNOLOGICAL AXES

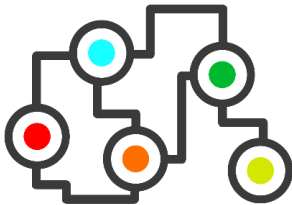
RAINBOW considers a number of cornerstone technologies that will be re-used or even enhanced during the materialization of its architecture:

Containerization and Orchestration

RAINBOW is interested in the **definition of service graphs that represent applications using the micro-service paradigm**, and then provision of the micro-service in a pool of available Fog resources.



Mesh Networking



With RAINBOW aiming to operate on top of dynamic, heterogeneous and complex networks, problems such as **dynamic routing and IP assignment** have been tackled through the incorporation of a **reactive routing protocol** in combination with a high-level protocol for **Fog Node onboarding**.

Trust Assurance

RAINBOW will include the provision of secure, robust, and efficient runtime behavioural attestation and verification methods to check the internal state of an untrusted fog-based environment. By developing a **trusted framework for attestation and system assurance** it seeks to establish **fog/edge node communities of trust**.



RAINBOW DEMONSTRATORS

RAINBOW plans to test and validate its technology suite by three strong applications implemented through realistic scenarios and pragmatic conditions.



Human-Robot Collaboration
in Industrial Ecosystems



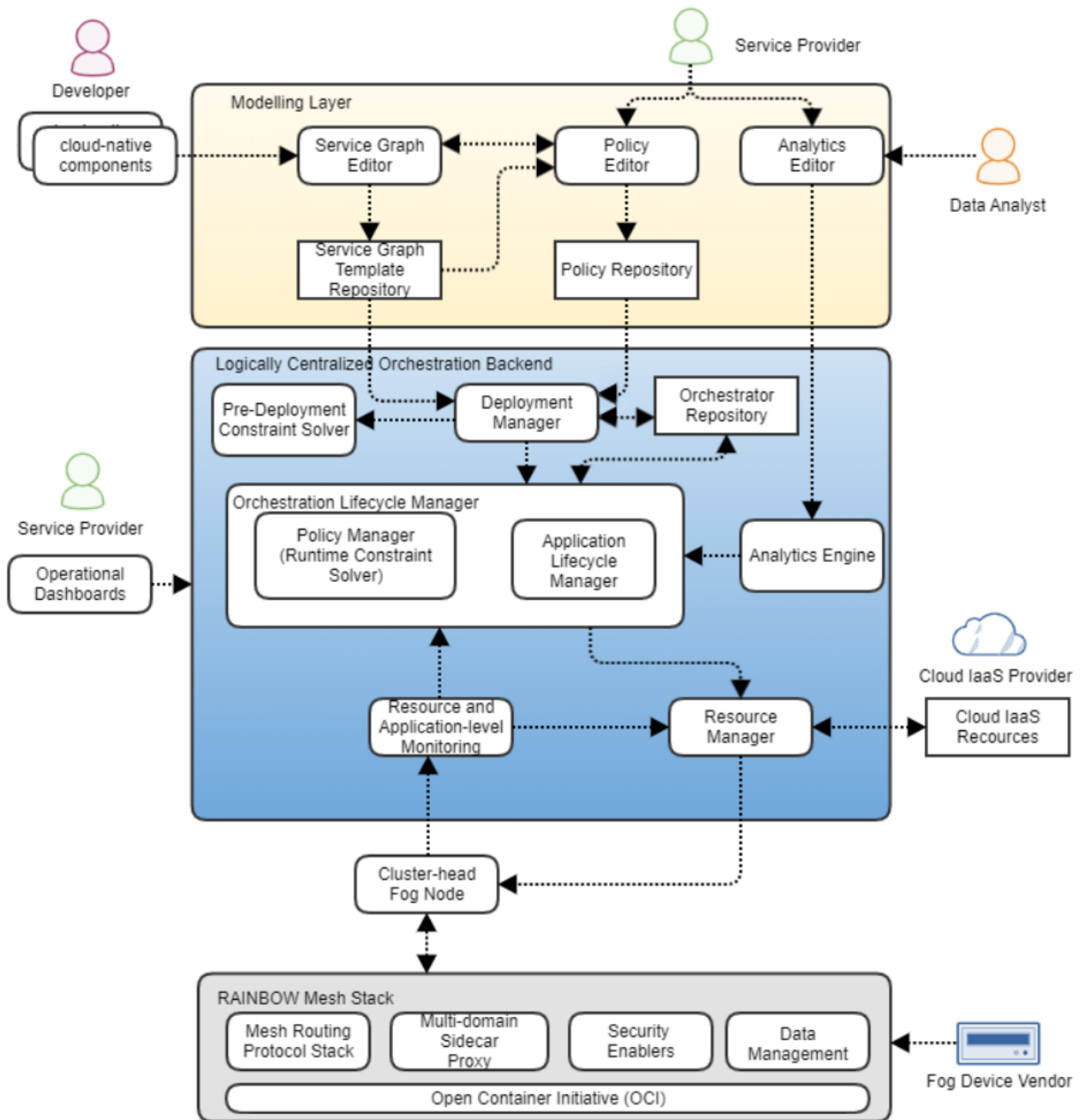
Digital Transformation
of Urban Mobility



Power Line Surveillance
via Swarm of Drones

RAINBOW ARCHITECTURE

Our platform will be materialized through a multi-layer architecture where each layer comprises a set of discrete components that interact with each other, while five distinct roles are identified as key actors in the **RAINBOW** ecosystem.





RAINBOW COMPONENTS

Modelling Layer

Service Graph Editor

author and maintain application templates of cloud-native components accompanied by requirements constraints

Analytics Editor

create or edit analytic queries; declaration of optimization strategies and constraints

Policy Editor

author and validate design-time and runtime policies

Logically Centralized Orchestration

Pre-deployment Constraint Solver

facilitate the identification of an optimal placement plan of a service graph

Resource Manager

track available and allocated resources on every node

Deployment Manager

implement a placement plan based on the state and availability of resources

Resource & App-level Monitoring

collect and provide monitoring data regarding resource utilization from the underlying fog infrastructure

Orchestration Lifecycle Manager

coordinate service graph deployment; check the fulfilment of Service Level Objectives; abstraction model of corrective actions; maintain consistent view of physical resources; conflict resolution

Mesh Layer

Mesh Routing Protocol Stack

secure onboarding and operation of a consistent network overlay among the fog nodes and the selection of a cluster-head

Security Enablers

provide enhanced remote attestation mechanisms towards achieving privacy-preserving attestation and secure composability of the fog environment

Data Management & Analytics Layer

Data Storage and Sharing

store and provide access to collected data and metadata

Analytics Engine

offer high-level analytics out of data stemming from IoT services and infrastructure scattered across the network



RAINBOW SYNERGIES

In order to maximize its reach and impact, **RAINBOW** sought to establish a series of synergies and strong cooperation links with initiatives from the EU cloud computing community. In this context, **RAINBOW** has initially joined forces with Horizon 2020 projects **H-CLOUD** and **PLEDGER**.

H-CLOUD leads coordination and support activities for the consolidation and growth of the Cloud Computing research and innovation community in Europe, bringing together innovators, policy makers, cloud computing research, industry and users into an open, participatory and sustainable forum. The H-CLOUD Forum will strengthen collaboration to address challenges and opportunities at research, technological, policy, standardisation and organisational level to unlock the potential of cloud computing for all European stakeholders.



Find more at: <https://www.h-cloud.eu>



PLEDGER aims to deliver a new architectural paradigm that will pave the way for next generation Edge Computing infrastructures, tackling the modern challenges and coupling the benefits of low latencies on the Edge with the robustness and resilience of cloud infrastructures. It will also allow Edge Computing users to understand the nature of their applications, research understandable quality of service metrics and optimise the competitiveness of their infrastructures.

Read more at: <http://www.pledger-project.eu>



RAINBOW ACHIEVEMENTS

Congratulations to our colleagues from the Laboratory for Internet Computing, Department of Computer Science, University of Cyprus, who received the best demo award in the 5th ACM/IEEE Symposium on Edge Computing (SEC '20) for their work on *Fogify*, an open-source emulation framework easing the modelling, deployment and experimentation of fog testbeds. A scientific result that came through their excellent research work in **RAINBOW**.

More info on *Fogify* is available at its GitHub repository <https://ucy-linc-lab.github.io/fogify>



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