RAINBOW NEWSLETTER

ISSUE 7, MARCH 2022

RAINBOW is a Research and Innovation Action funded 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.

RAINBOW EARLY-STAGE EVALUATION

Since the first release of the RAINBOW platform in summer 2021, the consortium has carefully planned its deployment along with specific testing and validation scenarios under the project's three use cases, coming up with a **complete evaluation methodology and framework**.

The demonstrators deployed the RAINBOW platform at their premises and executed the designed test cases in order to **collect metrics** and **evaluate predefined indicators** that relate to the anticipated impact.

This process provided **useful insights** to further optimization and refinement of the ongoing platform development while also enhancing the focus of RAINBOW's value proposition in the cutting-edge domains of our demonstrators. Additionally, allowed for the establishment of **adoption guidelines** with regards to the wider applicability and usability of the RAINBOW platform targeting a greater industrial and research audience.

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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 #Industry40
#EdgeComputing #secureIoT

https://rainbow-h2020.eu

HUMAN-ROBOT COLLABORATION

The Human-Robot Collaboration in Industrial Ecosystems use case is focused on **low-latency** and **physical personnel safety** for optimal human-robot symbiosis in a working environment. The early-stage technical evaluation under this use case successfully completed testing pertaining to:

- Horizontal scale-out of Personnel Location and Motion Capturing services
- Horizontal scale-in of Personnel Location and Motion Capturing services
- Horizontal scale-out of Collision Prediction & Avoidance services
- Horizontal scale-in of Collision Prediction & Avoidance services
- Horizontal scale-out of Robot Motion Tracking services
- Horizontal scale-in of Robot Motion Tracking services
- Monitoring and evaluation of Service Level Objectives
- Data sharing

Key takeaways from the lessons learnt from this use case include the success of RAINBOW to **simplify the deployment of complex applications**, as well as the **visualisation of such deployments via the RAINBOW UI**, despite the lack of automated deployment scripts. On the other hand, in its current development status, the RAINBOW platform does not yet **support a high degree of configurability** and requires hands-on interaction to troubleshoot deployments issues with the underlying infrastructure.

DIGITAL TRANSFORMATION OF URBAN MOBILITY

The Digital Transformation of Urban Mobility use case is focused on **low-latency** and **overall system reliability** as well as **node trust-enabling**. The early-stage technical evaluation under this use case successfully completed testing pertaining to:

- Automatic Hazardous Events Detection service orchestration power consumption
- Automatic Hazardous Events Detection service orchestration bandwidth occupancy

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Key takeaways from the lessons learnt from the second use case include the **measurable simplification of the deployment processes** thanks to RAINBOW. This test scenario faced issues since the platform currently lacks the capability to migrate services between nodes with ARM64 and AMD64 processor architectures and also identified the **need for a more dynamic overall deployment method**.

POWER LINE SURVEILLANCE VIA SWARM OF DRONES

The Power Line Surveillance via Swarm of Drones use case is focused on **automatic deployment**, **node trust-enabling** and **extending current system capabilities** on a technical level. The early-stage technical evaluation under this use case successfully completed testing pertaining to:

- Time to pass the control over the drone from one ground Control station to another
- Increase of productive flight distance per drone
- Reduction of data acquisition time per kilometre

Key takeaways of the lessons learnt from this use case include **the significant increase in operation efficiency**, while respective existing service architectures. Valuable points for improvement include the possibility to **modify service graphs on-the-go** and **reuse components in different service graphs**.

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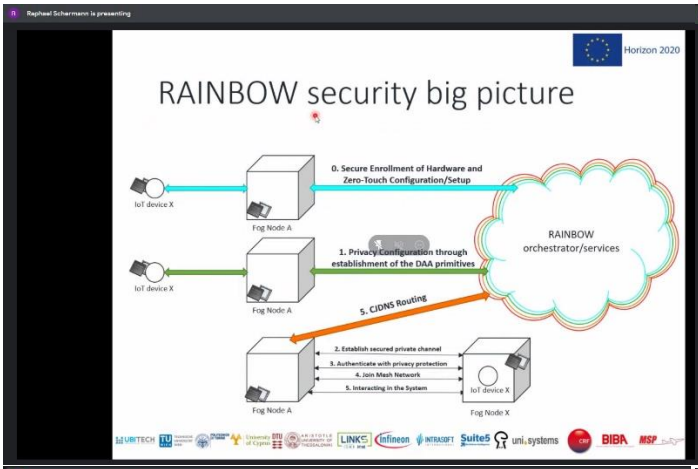
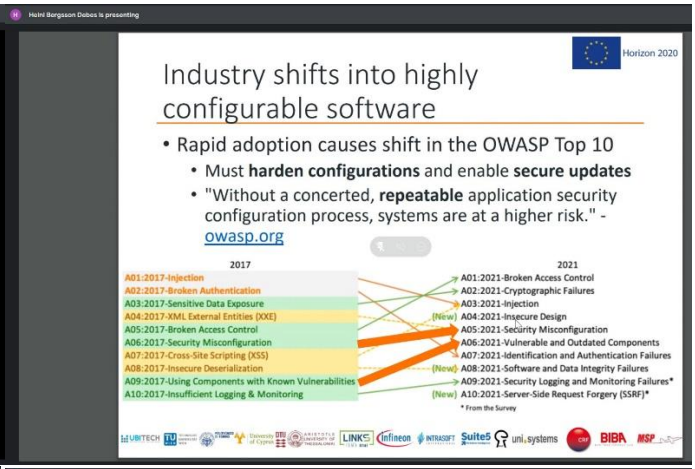
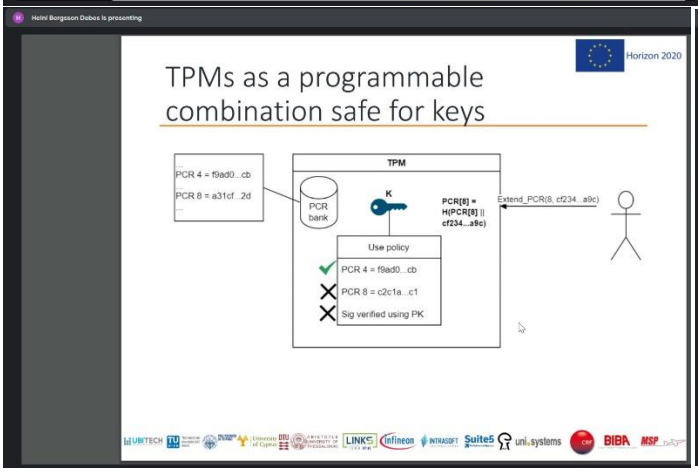
RAINBOW 1ST TECHNICAL WEBINAR

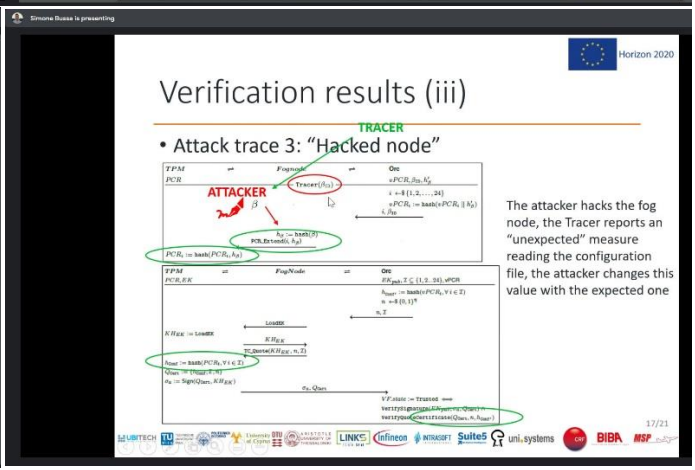
On February 22, 2022, RAINBOW successfully held its first technical webinar in the subject of "**RAINBOW Security and Trust in Fog Computing**". With data security and privacy being key challenges in Edge and Fog Computing, the event presented to participants the opportunity to learn how Trusted Platform Modules, attestation mechanisms and formal verification can strengthen trust and privacy in cloud computing. Project's partners from **Infineon Technologies**, **Danmarks Tekniske Universitet** and **Politecnico di Torino**, provided insights on how the RAINBOW approach to Fog Computing ensures trust and provable security for Fog and Cross-Cloud Services.

RAINBOW is planning a **series of webinars** on various technical aspects and applications related to Fog Computing. Stay tuned on our communication channels for more information!









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COLLABORATION WITH CENTAURUS PROJECT

Recently RAINBOW's **Fog-aware Kubernetes Scheduler** has been officially contributed to and forked by the **Polaris SLO Cloud** project, which is one of the Special Interest Groups of Linux Foundation's **Centaurus** project, an open-source platform for building a unified and scalable distributed cloud infrastructure. Their goal is to allow combining Cloud and Edge resources at a large scale and expose them as a unified infrastructure. The Polaris SIG occupies itself with making **Service Level Objectives** (SLOs) first class entities in cloud computing. With the RAINBOW Scheduler forked under the name **Polaris Scheduler**, the Polaris SIG is moving towards realizing its vision of an SLO-aware scheduler for the Edge. In its current state the scheduler is already capable of handling the heterogeneity of Fog/Edge resources and network SLOs.

The **Service Graph** is used to model the topology and specify the network SLOs of the applications that should be deployed. While in RAINBOW, the Service Graph is the main entity that is deployed and all pods are created from the Service Graph's nodes, the Polaris Scheduler relies on a lightweight version of the Service Graph, which is used as a **complement to Kubernetes native deployments**. Developers rely on the Service Graph to model the relationships between their applications' microservices and to specify the network Quality of Service requirements, i.e., SLOs. Kubernetes native deployments then need to reference the Service Graph object and a node within it using labels in their metadata, thus allowing the scheduler to discover the Service Graph and enforce its SLOs during the scheduling process.

Future Collaboration

Once Polaris Scheduler is fully integrated into Centaurus, certain SLO-aware enhancements may prove beneficial for RAINBOW as well and be backported to the upstream project. Vice-versa, improvements made on the RAINBOW Scheduler will continue to be contributed to the Polaris Scheduler and **make an impact** on the community of the Centaurus project and subsequently, **on future public and/or private Cloud-Edge infrastructures**.

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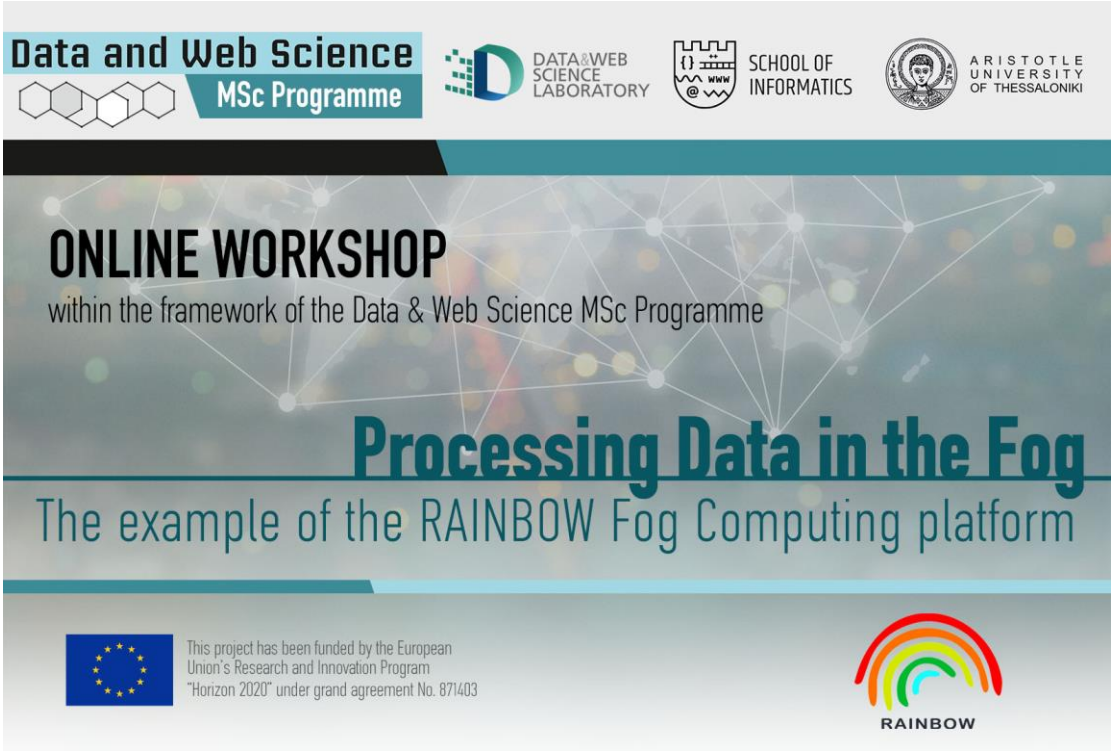
RAINBOW WORKSHOP

On Monday April 4, 2022 the Data & Web Science Laboratory of Aristotle University of Thessaloniki with the support of the RAINBOW project will host an online workshop on **"Processing Data in the Fog - The example of the RAINBOW Fog Computing platform"**. During the workshop there will be a tour of work related to distributed data management and analytics, as well as presentations of concrete examples based on the innovations developed by RAINBOW aimed at addressing the challenges of Edge and Fog Computing.



Additional information and registration details are available here: https://rainbow-h2020.eu/online-workshop-on-processing-data-in-the-fog-the-example-of-the-rainbow-fog-computing-platform/

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