DESIGN OF AN INNOVATIVE ENERGY-AWARE IT ECOSYSTEM FOR MOTIVATING BEHAVIOURAL CHANGES TOWARDS THE ADOPTION OF ENERGY EFFICIENT LIFESTYLES

# ENTROPY

# Design of an Innovative Energy-Aware IT Ecosystem for Motivating Behavioural Changes Towards the Adoption of Energy Efficient Lifestyles


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12 OCTOBER 2018, Athens, Greece

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# At a Glance

- Funding mechanism: EU H2020, RIA, Grant agreement No 649849
- Total Cost: 2.439.467,50 €
- Duration: 36 months
- Start Date: September 2015
- Consortium: 9 partners from 8 countries
- Project Coordinator: Universidad de Murcia (Spain)

# The ENTROPY Consortium

Universidad de Murcia (Spain) ***Coordinator***

ARVRtech (Serbia)

ELTRUN Res. Center AUEB (Greece)

HES-SO Valais-Wallis (Switzerlandt)

Hyperborea SRL (Italy)

Intelen Services Ltd. (Cyprus)

Polo Navacchio S.p.A. (Italy)

STI Universitaet Innsbruck (Austria)

Ubitech - Ubiq Sol. Ltd. (Greece)

# The Challenge

- Energy efficiency via ICT identified as significant contributor to cutting CO2 emissions by 2020
- Design & development of novel energy efficient solutions and examination of their potential for energy saving considered crucial
- The greatest energy saving potential lies in buildings (Energy Efficiency Plan 2011)
- To exploit this potential, innovative solutions that take into account occupants' energy behavior needed

# Project Focus

- **Target:**

  "To design and deploy an innovative IT ecosystem aimed at improving energy efficiency through consumers' engagement and behavioral change."

- **Focus:**
  - collection & analysis of energy-related info from heterogeneous data sources
  - provision of interactive services, apps and serious games to end-users towards:
    - (a) stimulating interest in energy efficient activities
    - (b) recommending actions for energy efficiency
    - (c) increasing energy consumption awareness

# Project Objectives

- ✓ **End-user engagement & Behavior Change** → more energy-efficient lifestyles
- ✓ **Innovative ICT solutions** → IoT- enabled energy consumption data aggregation, mobile crowd-sensing, advanced networking
- ✓ **Optimization & recommendation framework** → optimal energy consumption.
- ✓ **Energy data analytics framework** → meaningful analytics (consumption, efficiency & costs), detection of anomalies, corrective actions
- ✓ **Innovative serious games and personalized applications** → stimulation of collaboration & interaction towards energy efficiency & awareness
- ✓ **Personalized behavioral analysis & consumption disaggregation** → tools for monitoring & comparing energy-consuming sources in real time
- ✓ **Address key socio-economic issues** → towards large scale up-take & deployment of proposed ICT solutions
- ✓ **Validate & Evaluate the research results** → develop proof-of-concept showcases, to prove applicability & effectiveness of solutions

# Methodology

- Design & deploy an innovative energy-aware IT ecosystem to motivate user engagement and behavioral change towards the adoption of more energy efficient lifestyles, that builds upon:
  - IoT technologies for interconnecting devices & collecting energy-related information
  - advanced data modelling & analysis techniques that support the realization of semantic models and knowledge extraction
  - recommendation & gamification mechanisms to:
    - stimulate users' interest for energy efficient activities
    - increase awareness of daily energy consumption patterns
    - educate in adopting more energy efficient lifestyles
  - serious games and personalized mobile apps that:
    - provide energy-related information and recommendations
    - engage end users towards energy saving
- Evaluate the designed solution through application in 3x pilot sites

# 3 Pilot Sites / Workplaces

- Site 1: The Navacchio Technology Park (Business Incubator)

  *in Pisa, Italy*

- Site 2: The Technology park & University campus

  *in Murcia, Spain*

- Site 3: The Technopole (Technology Park)

  *in Sierre, Switzerland*

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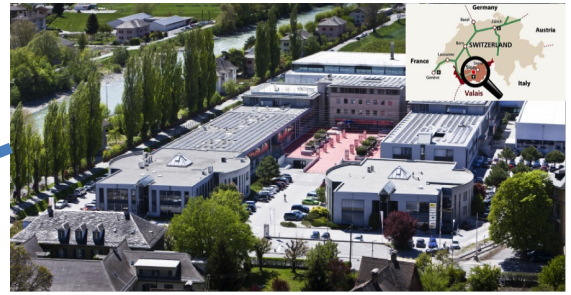
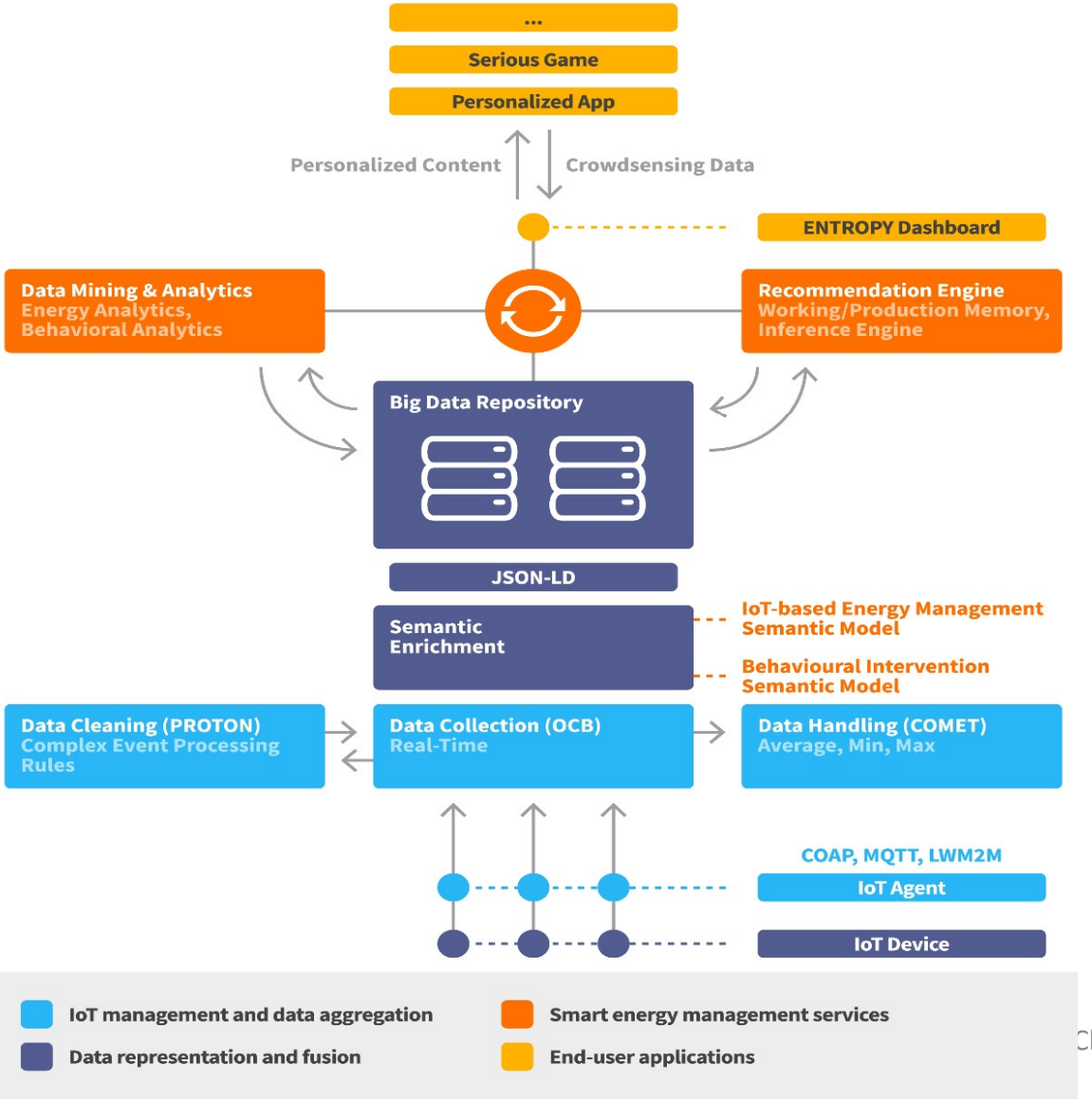


# Outcomes

- ✓ Open, generic ENTROPY Reference Architecture
- ✓ Innovative Energy-Aware Infrastructure Monitoring Parameters Semantic Model
- ✓ Innovative Citizens Environmental Friendly Behavioral Semantic Model
- ✓ Scalable, modular and extendable IoT-enabled ENTROPY Ecosystem, comprised of:
  - Data Modeling, Fusion & Analytics / Recommendation / Gamification / Behavioral Assessment Frameworks
  - ENTROPY Personalised Mobile Applications and Serious Games
- ✓ ENTROPY Pilots' results that will justify the utilization of persuasive technologies as sustainable energy behavior change drivers
- ✓ Educational content for energy behavior change, delivered through the ENTROPY services and tools
- ✓ Wide-scale dissemination & exploitation of project results to academic, scientific & industrial stakeholders

# The ENTROPY Reference Architecture



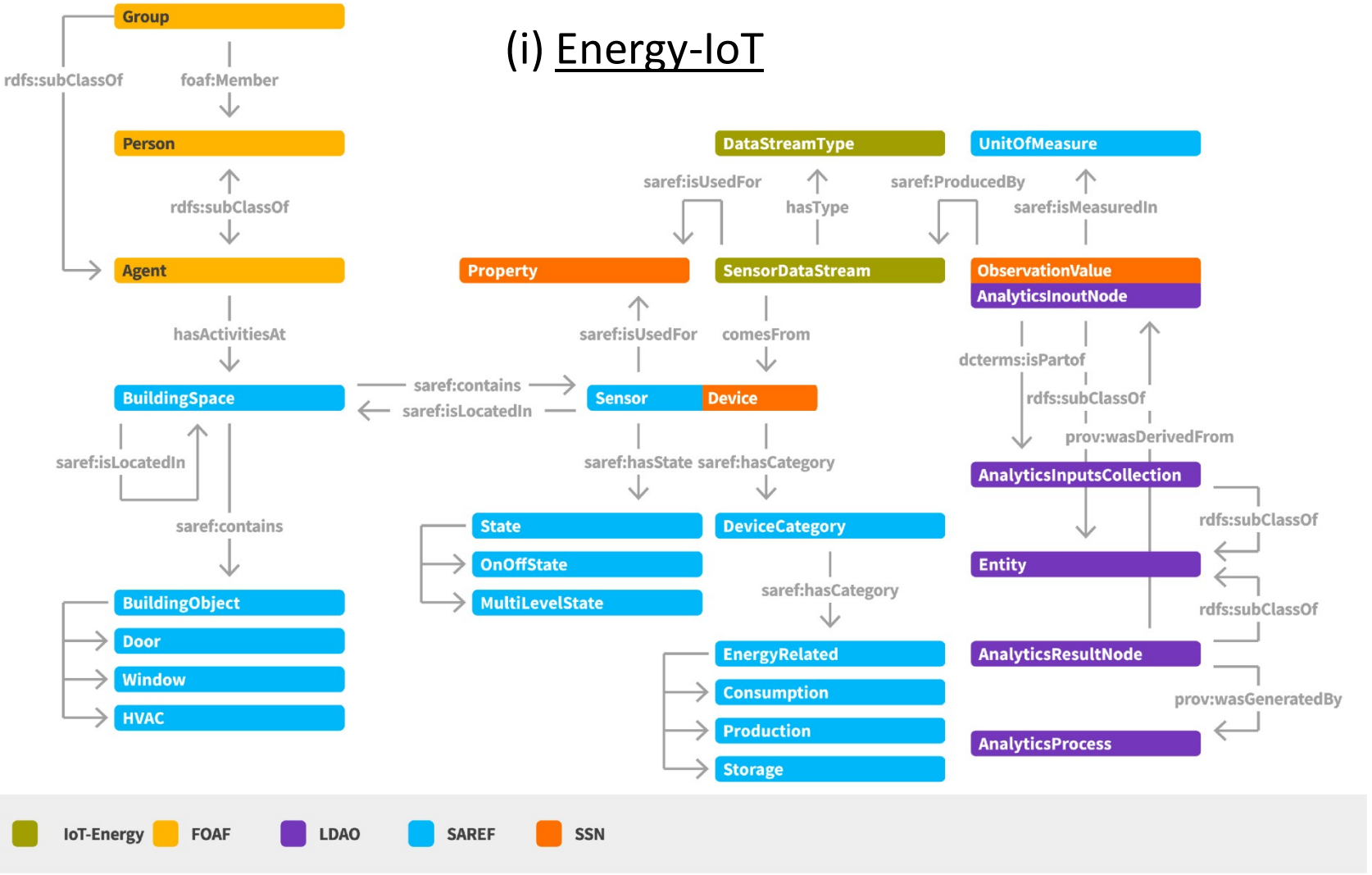

Composed of 4 layers:

- ENTROPY apps
- Smart energy management services: (a) data mining & analytics (b) Recommendation Engine
- Data processing and storage in big data repository
- Sensor management and data aggregation

# The ENTROPY Semantic Models

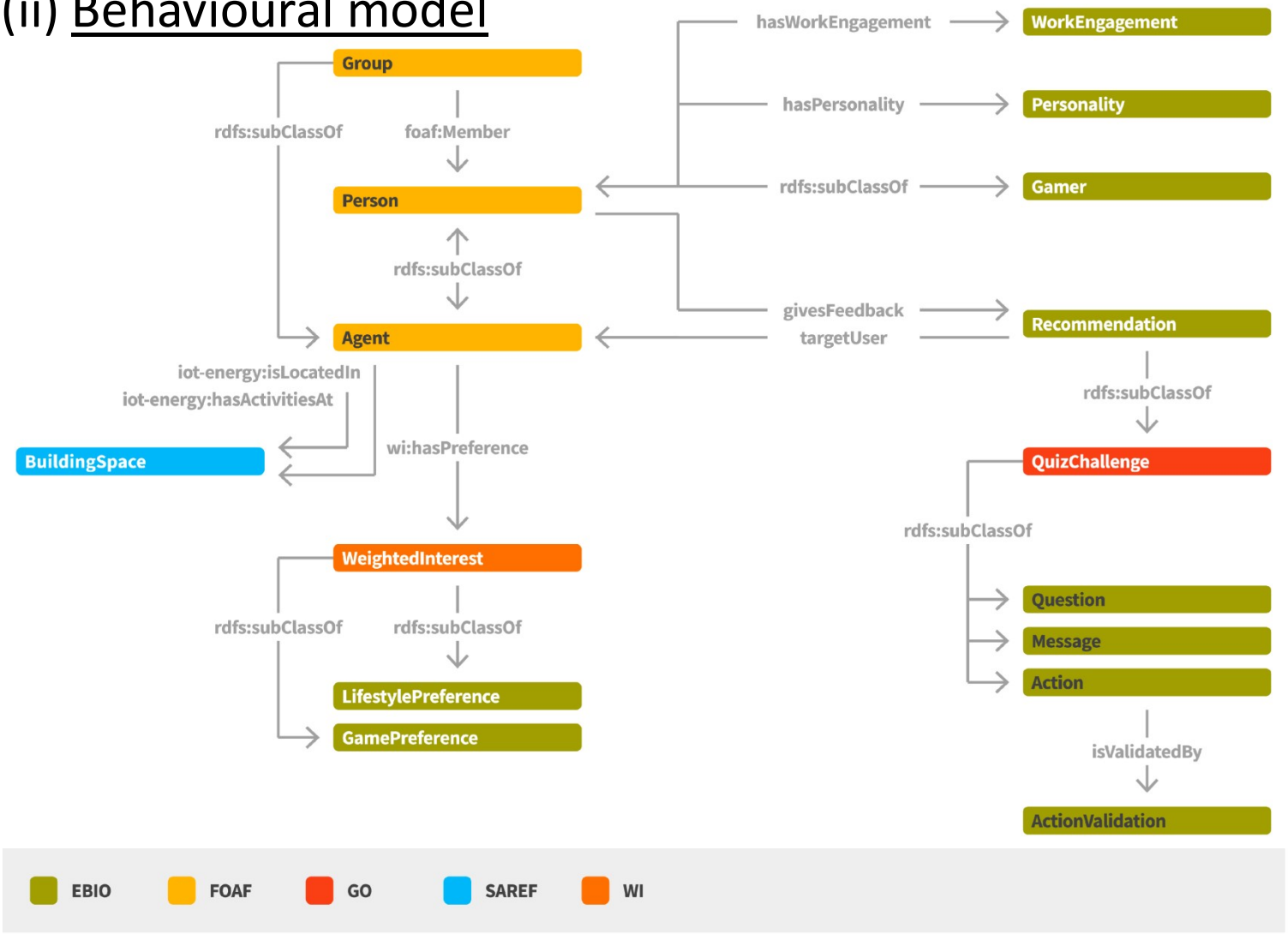
## 2x interconnected models:

### (i) Energy-IoT

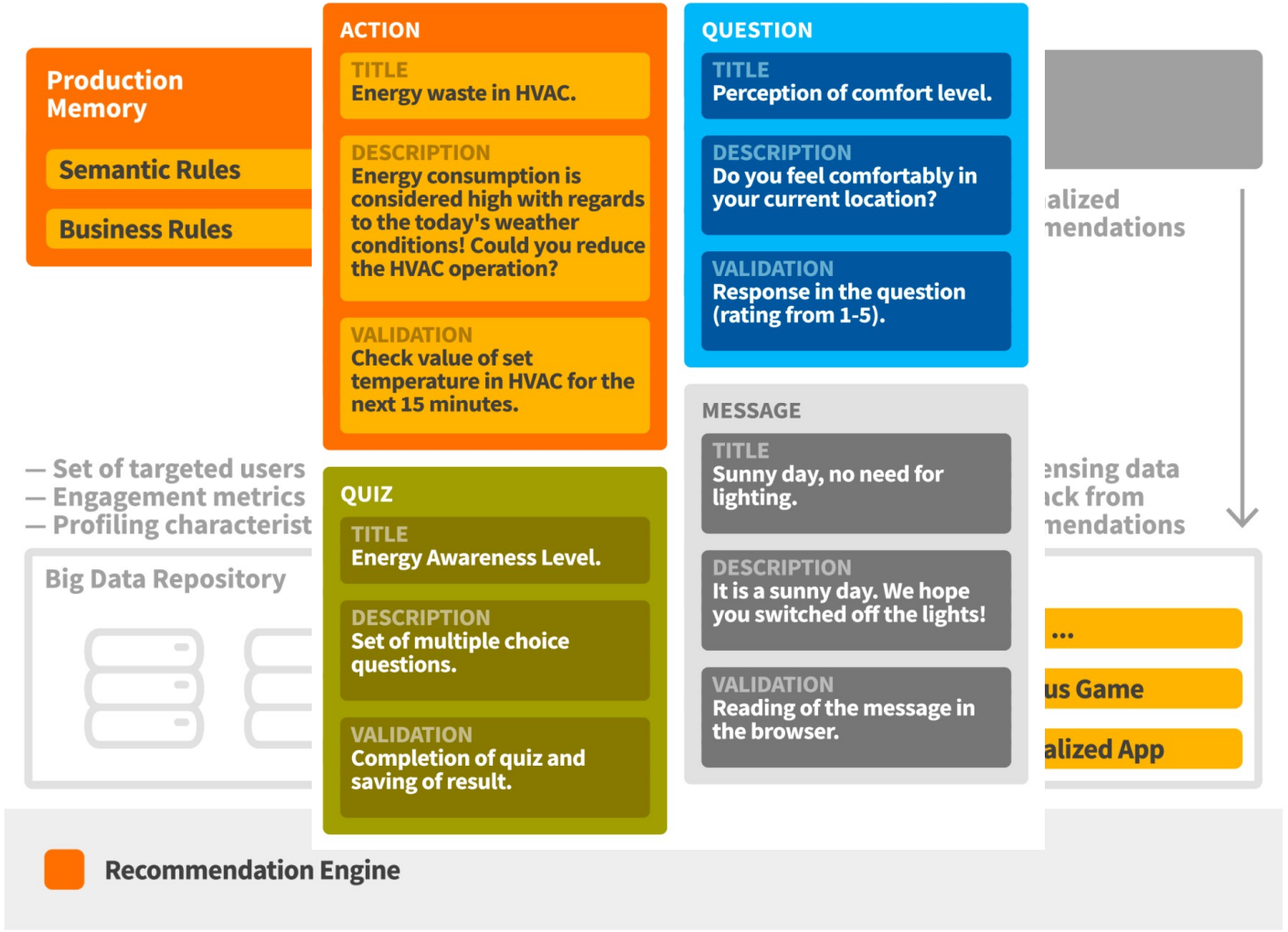


# The ENTROPY Semantic Models

## (ii) Behavioural model



# Recommendation Mechanisms



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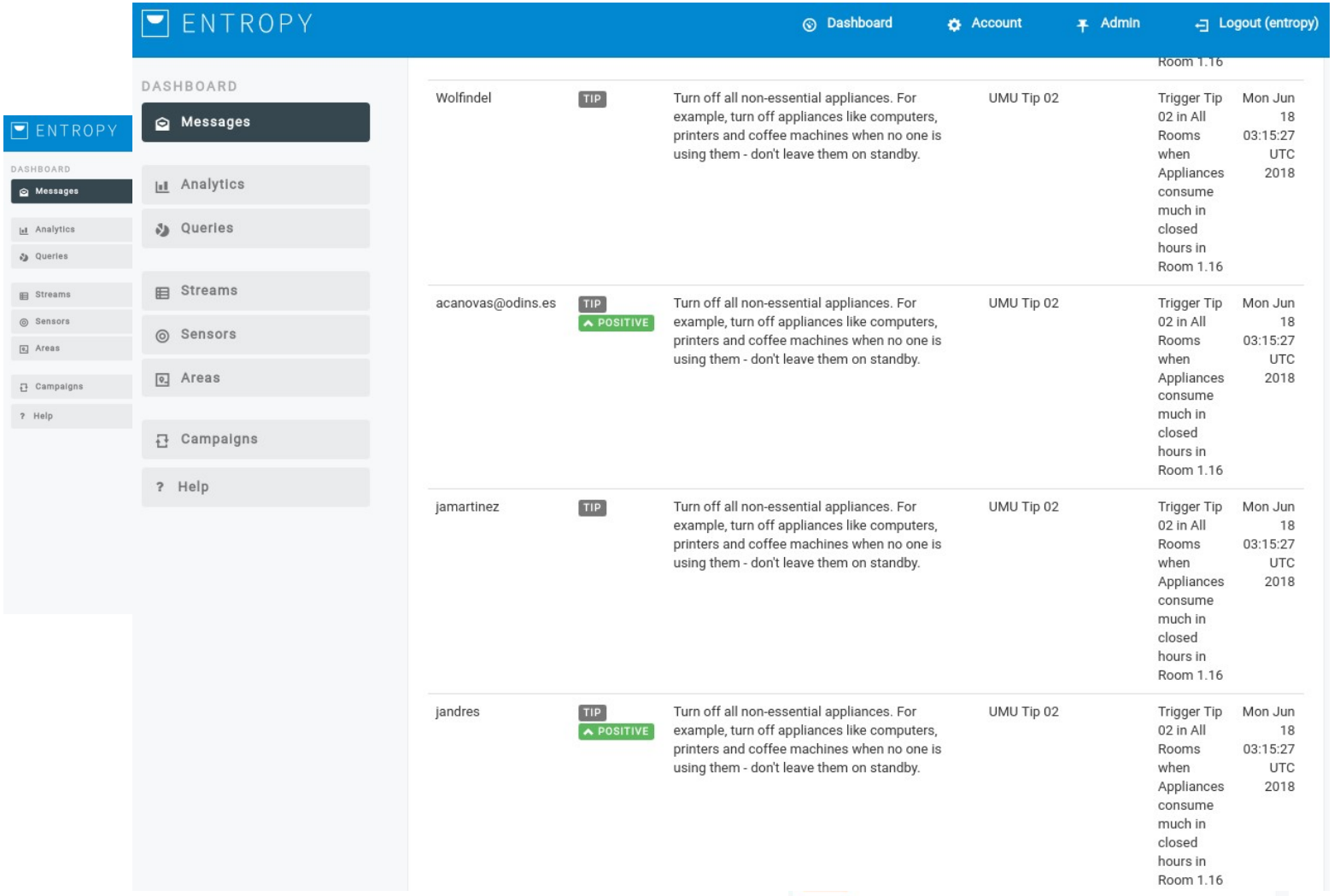
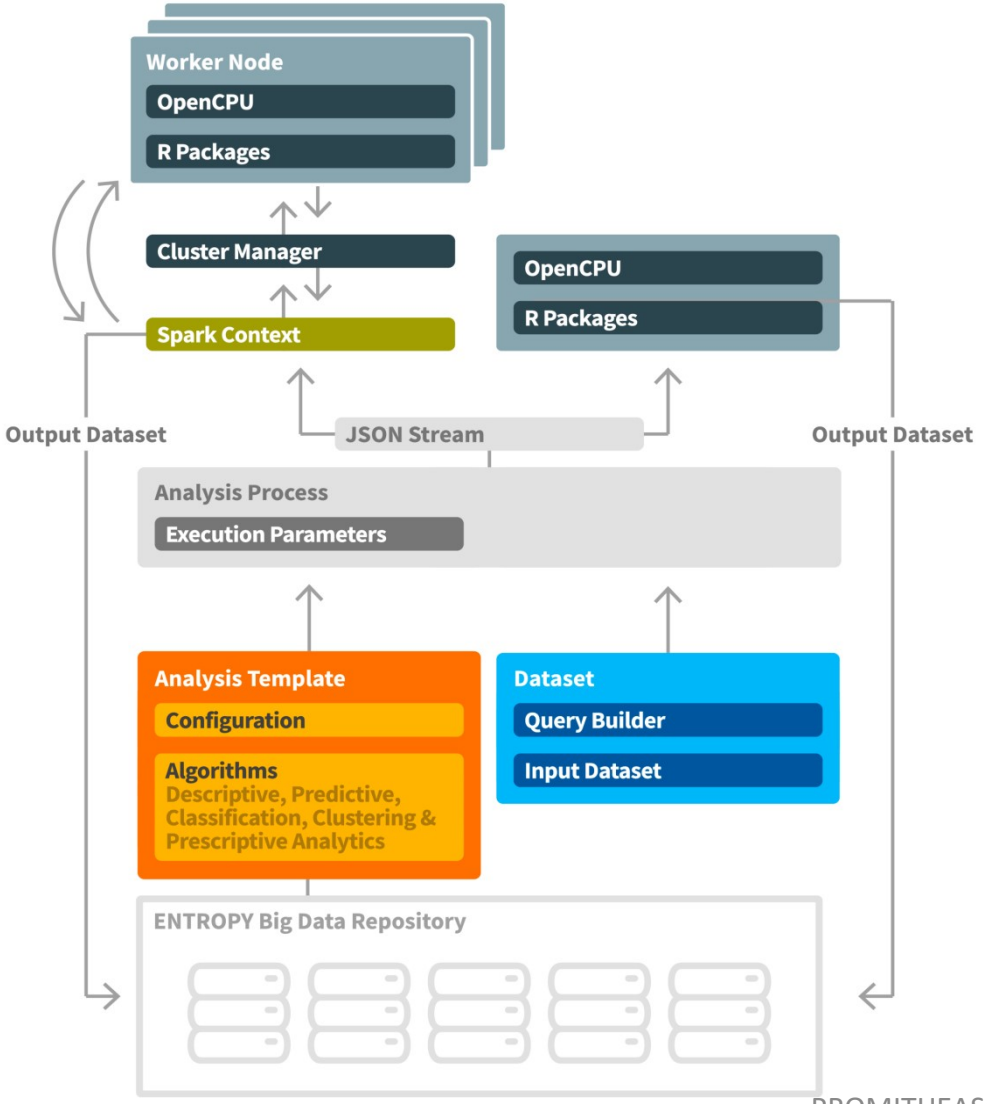
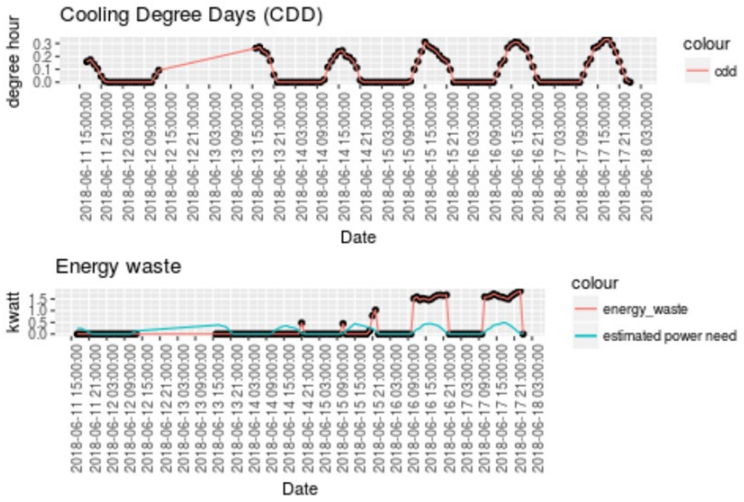
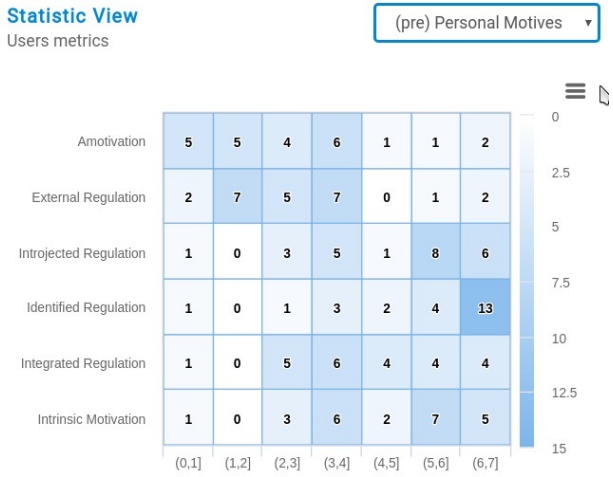


# Energy & Behavioral Data Analytics



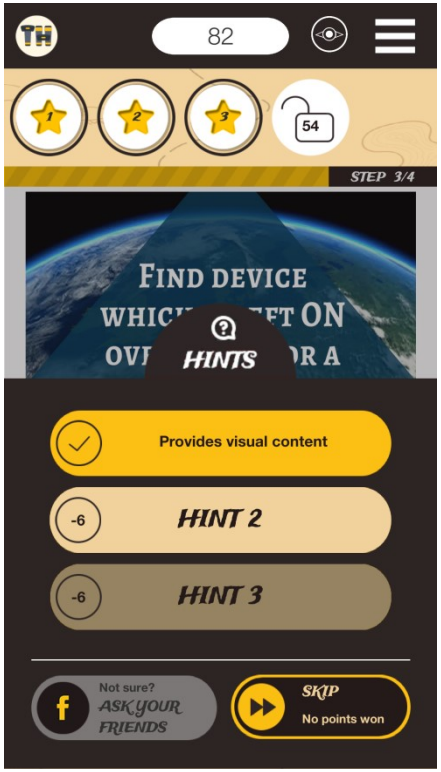



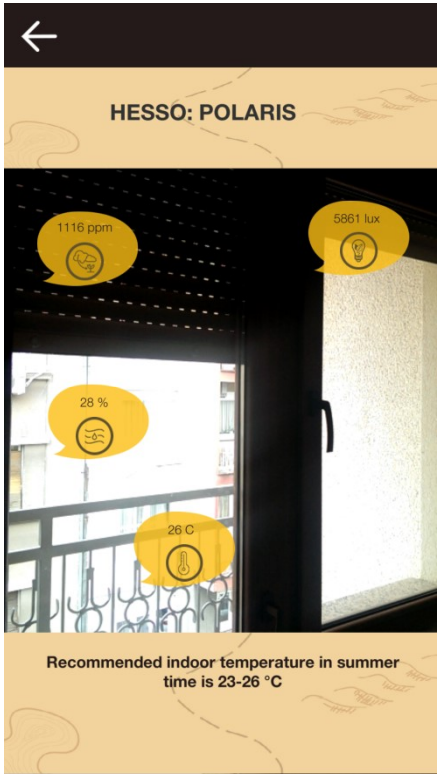

Calculation of cooling degree days & energy waste

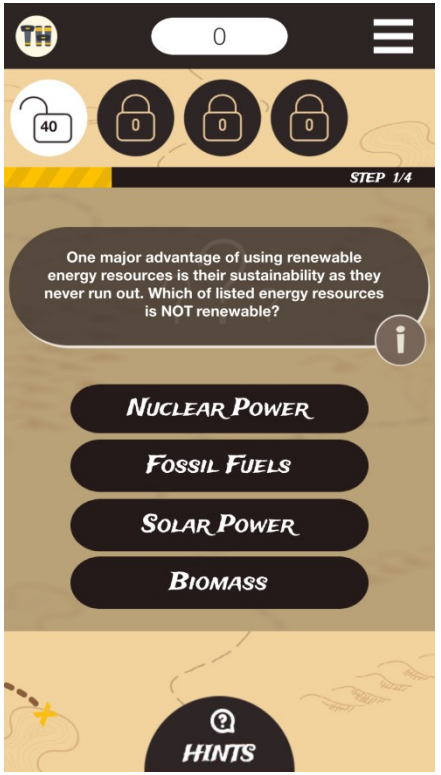



Heatmap with behavioral characteristics

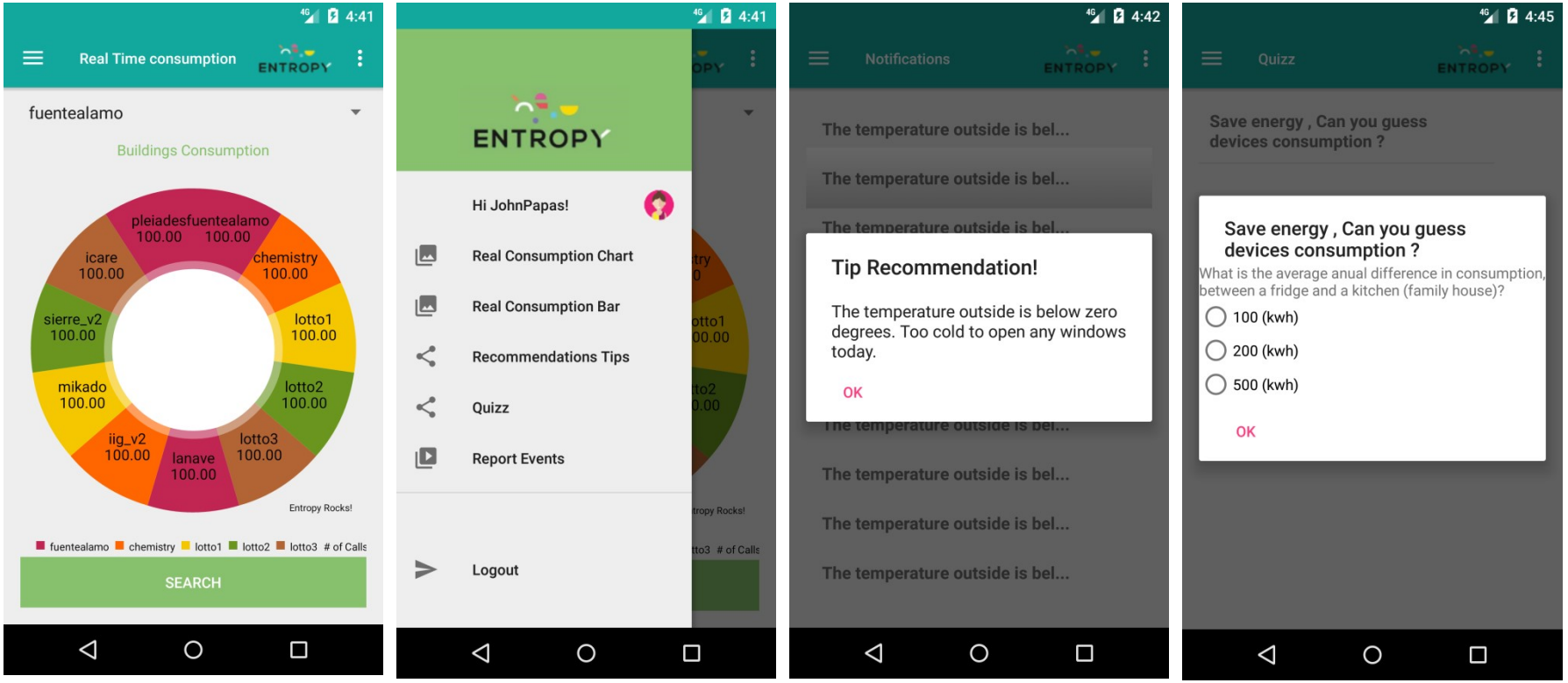
# The ENTROPY AR "Treasure Hunt" Serious Game



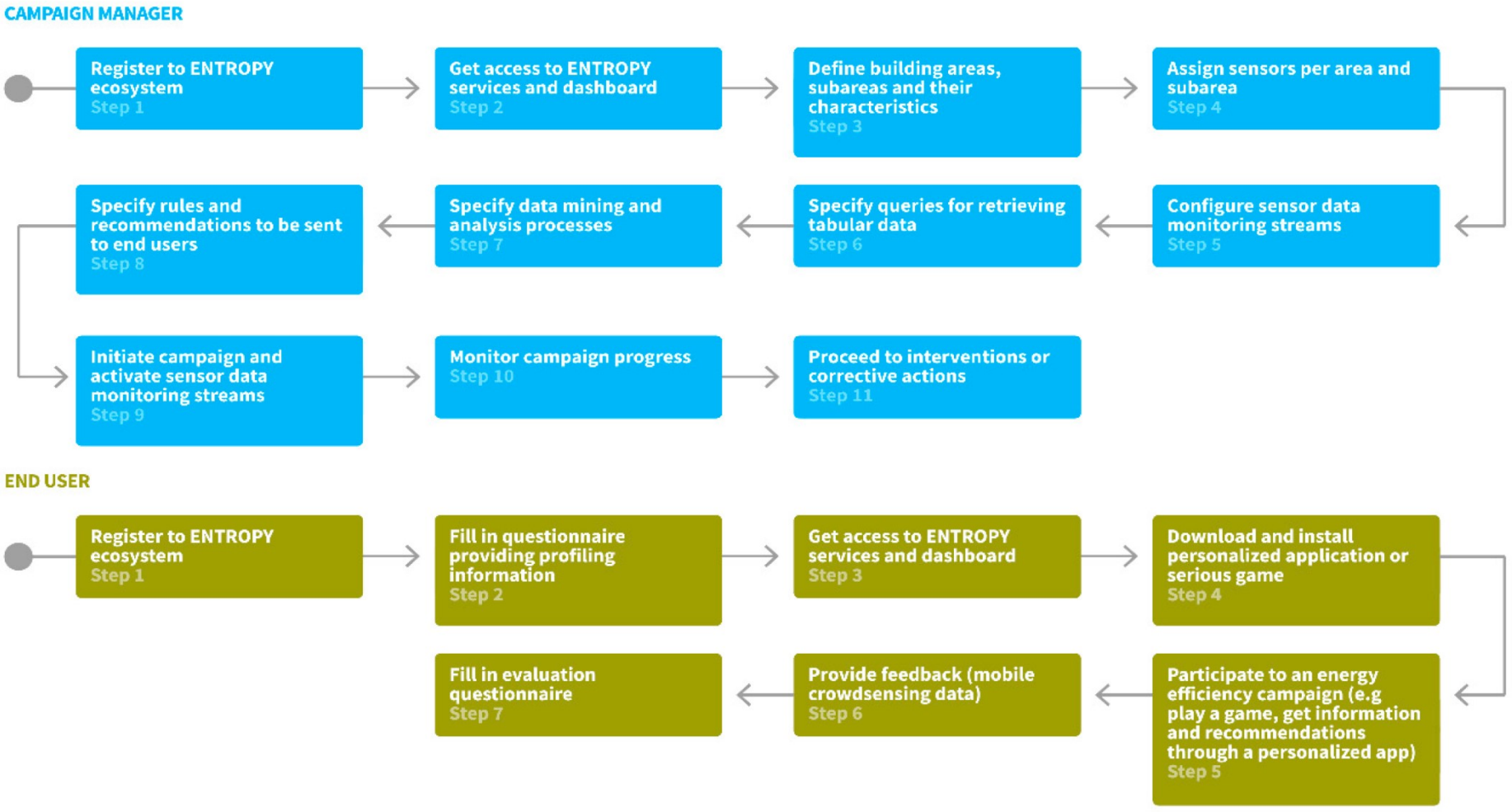



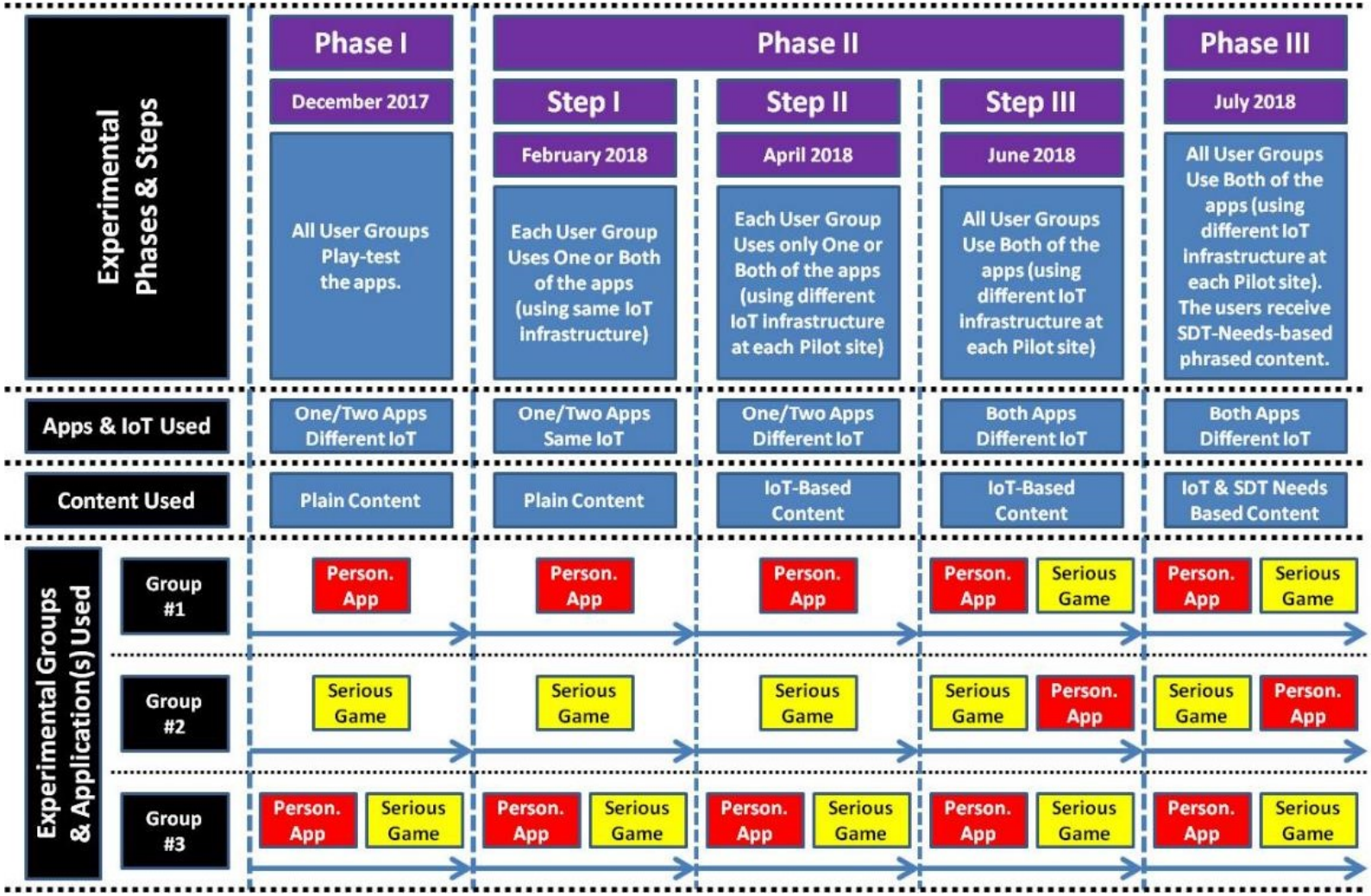

# The ENTROPY Personalized GamifiedApp



# Campaign Workflow



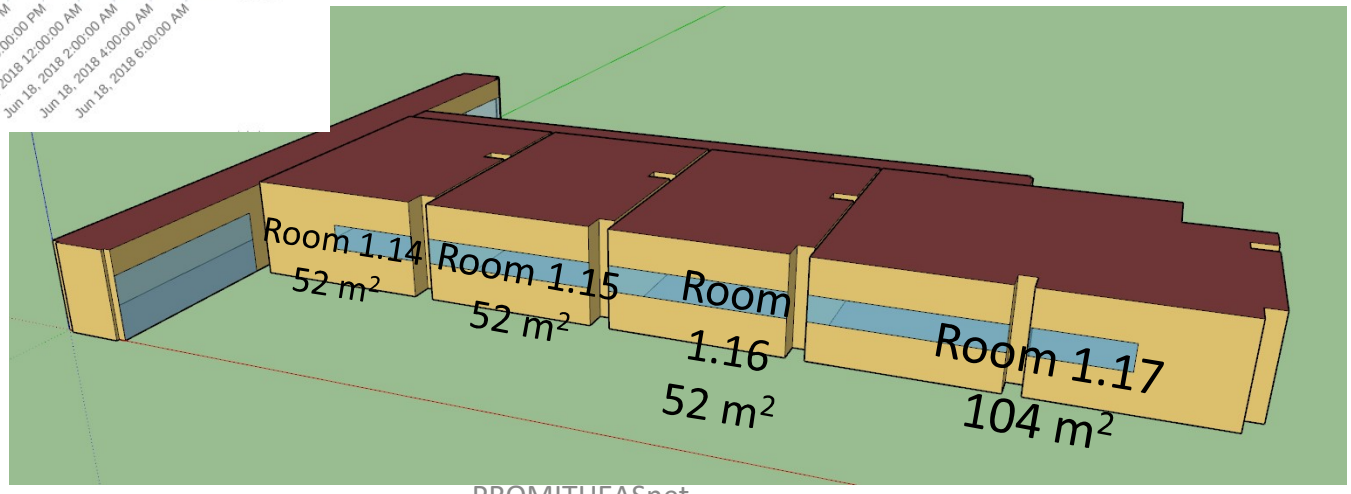
# Pilots' Execution



# Campaigns Execution – University of Murcia



**Pleiades Building**



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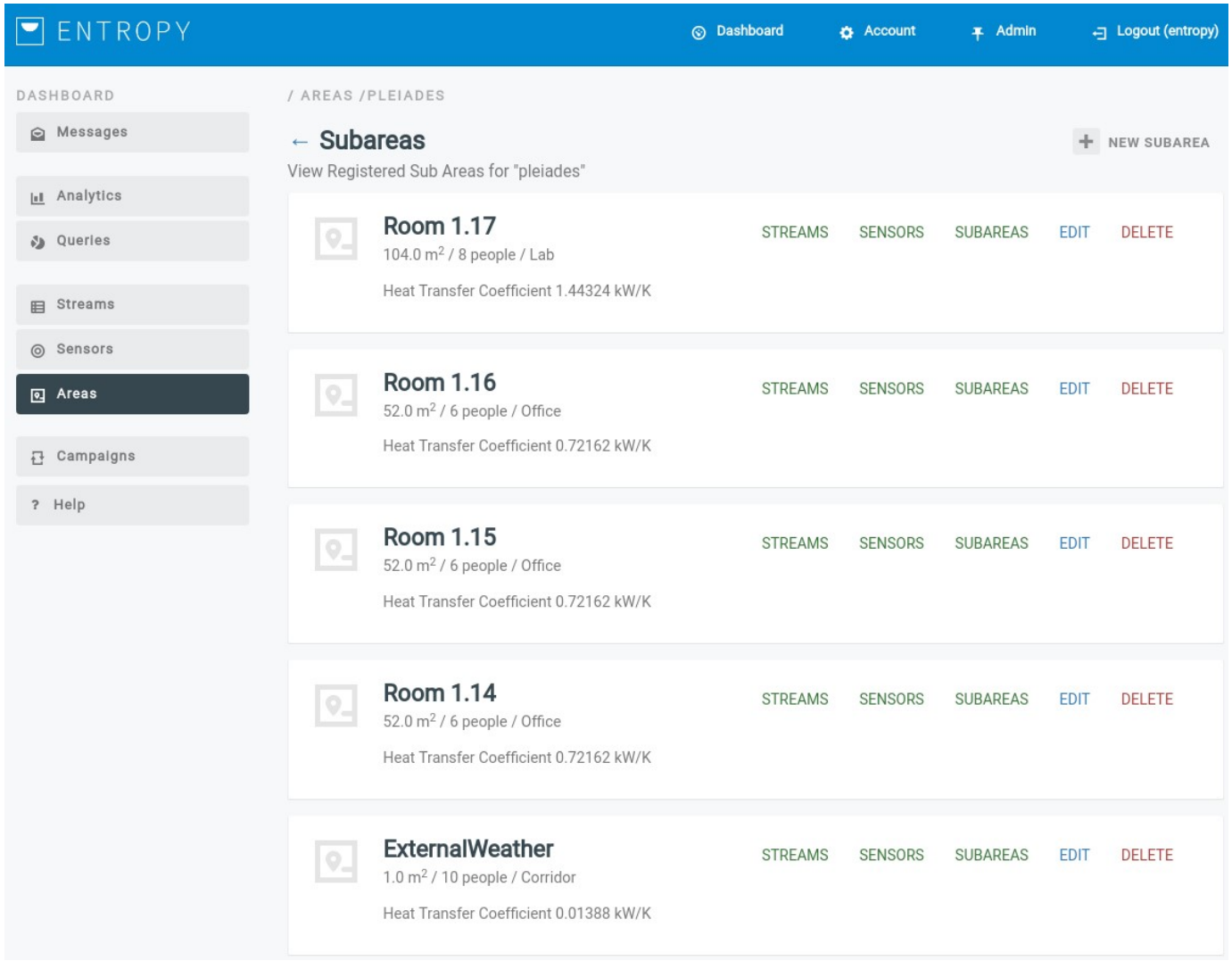

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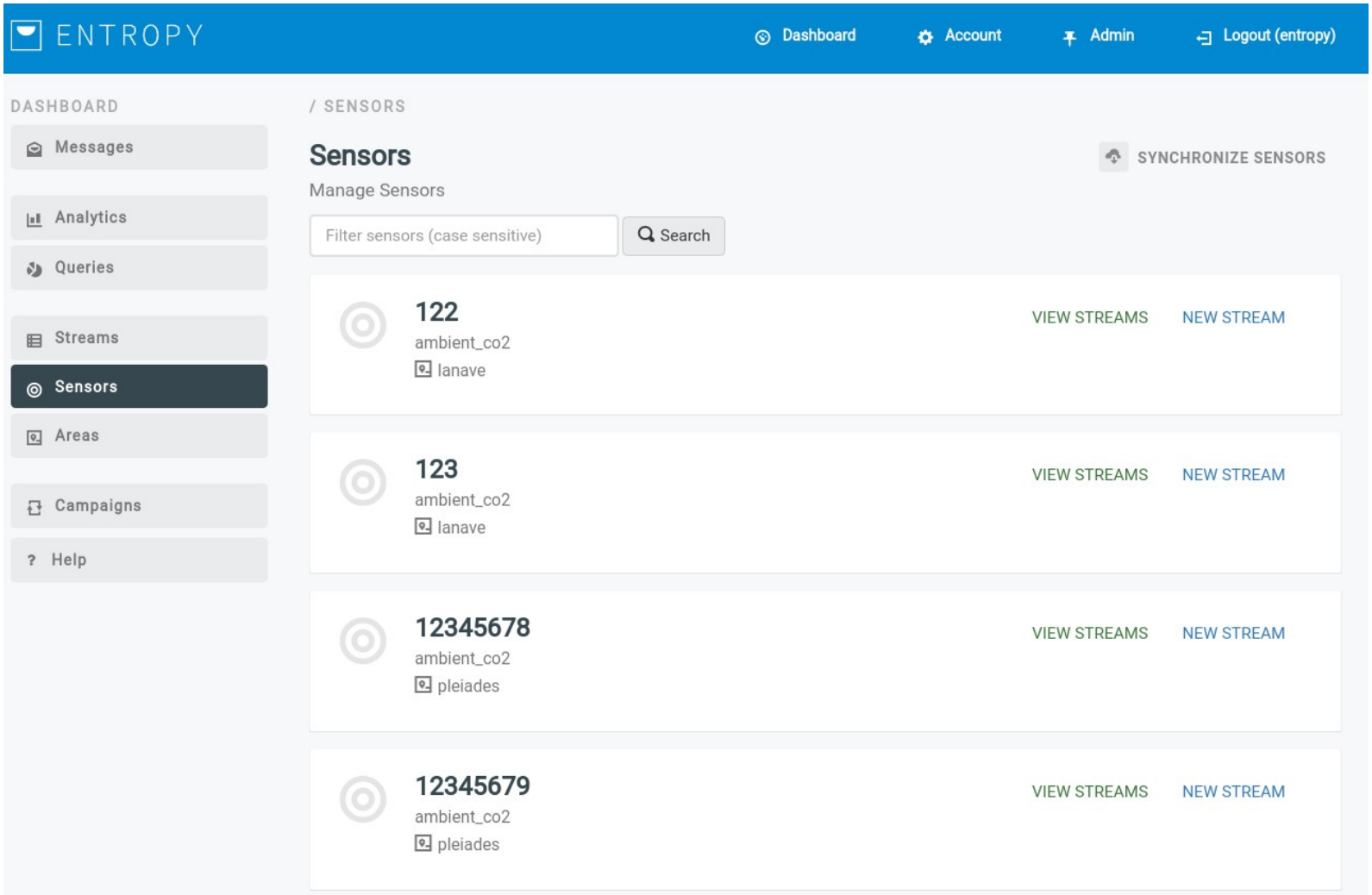

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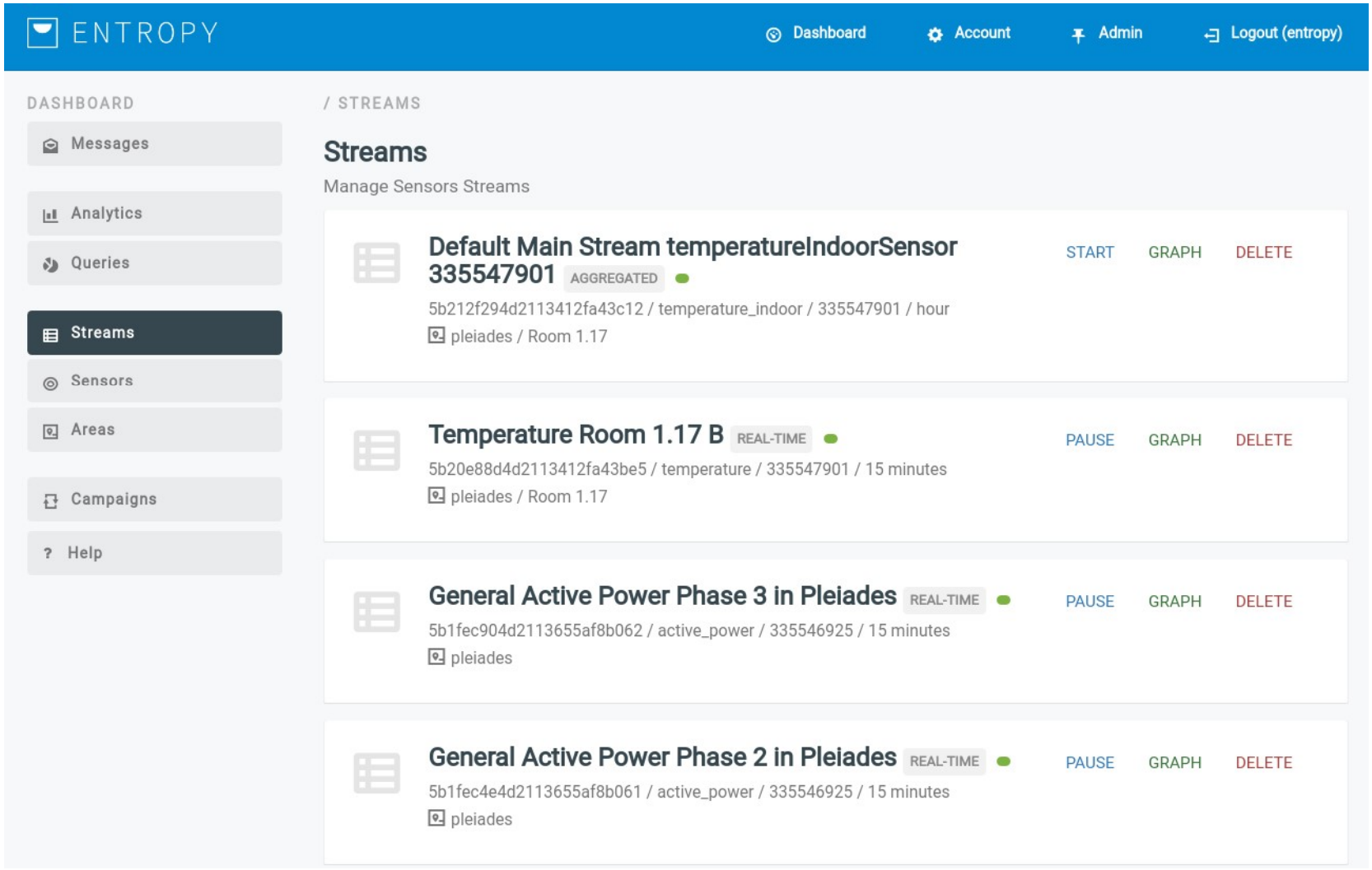

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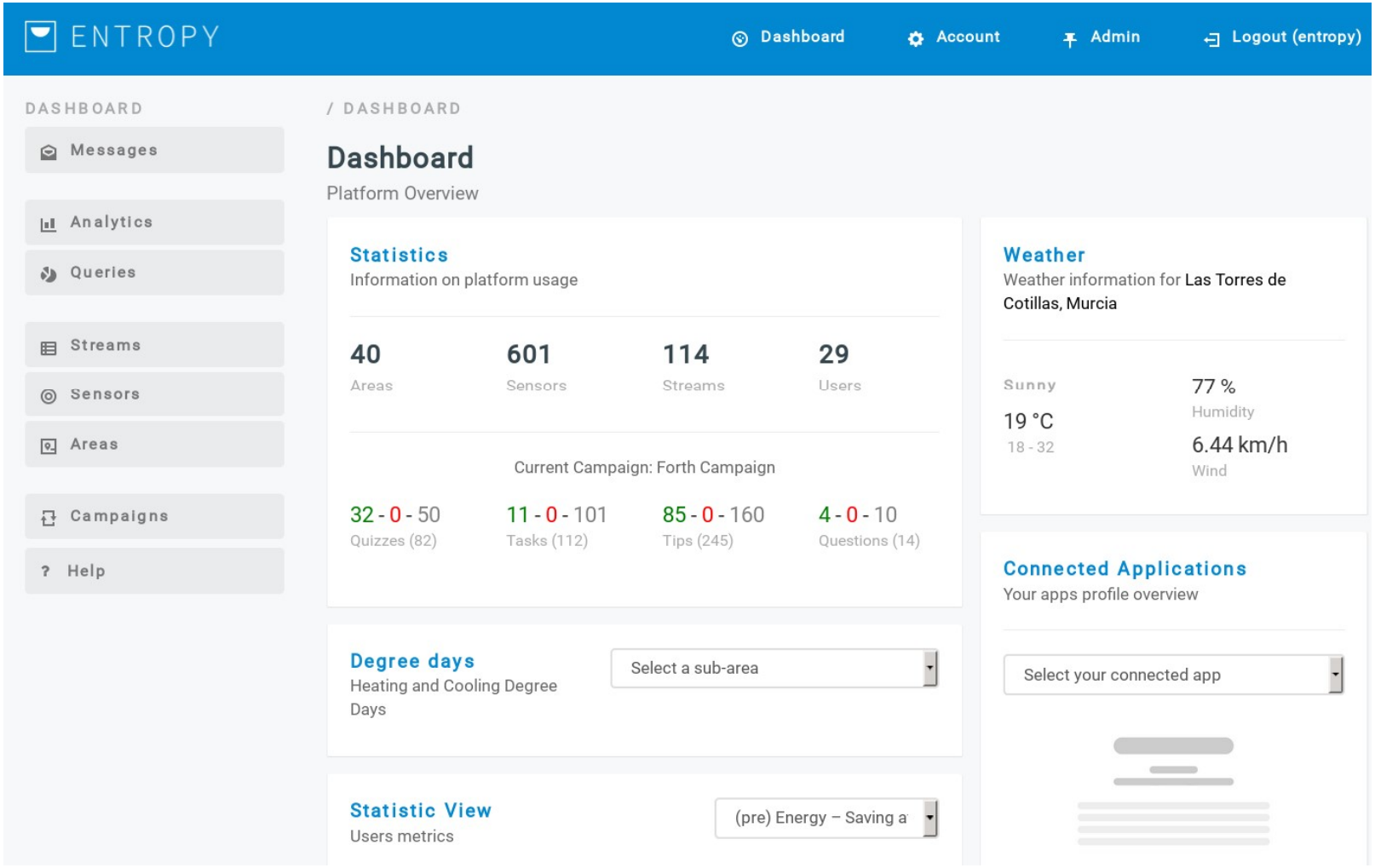

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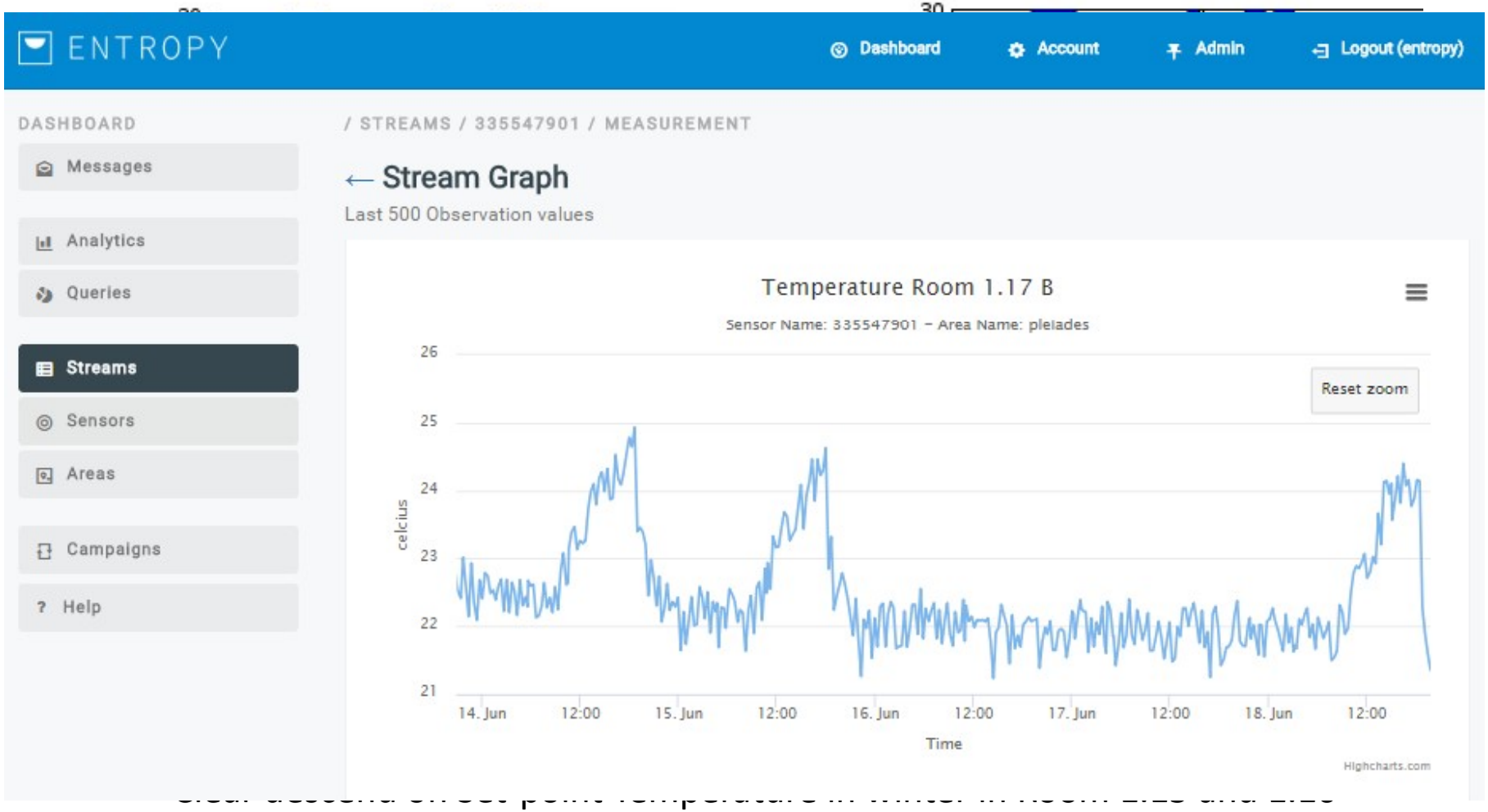

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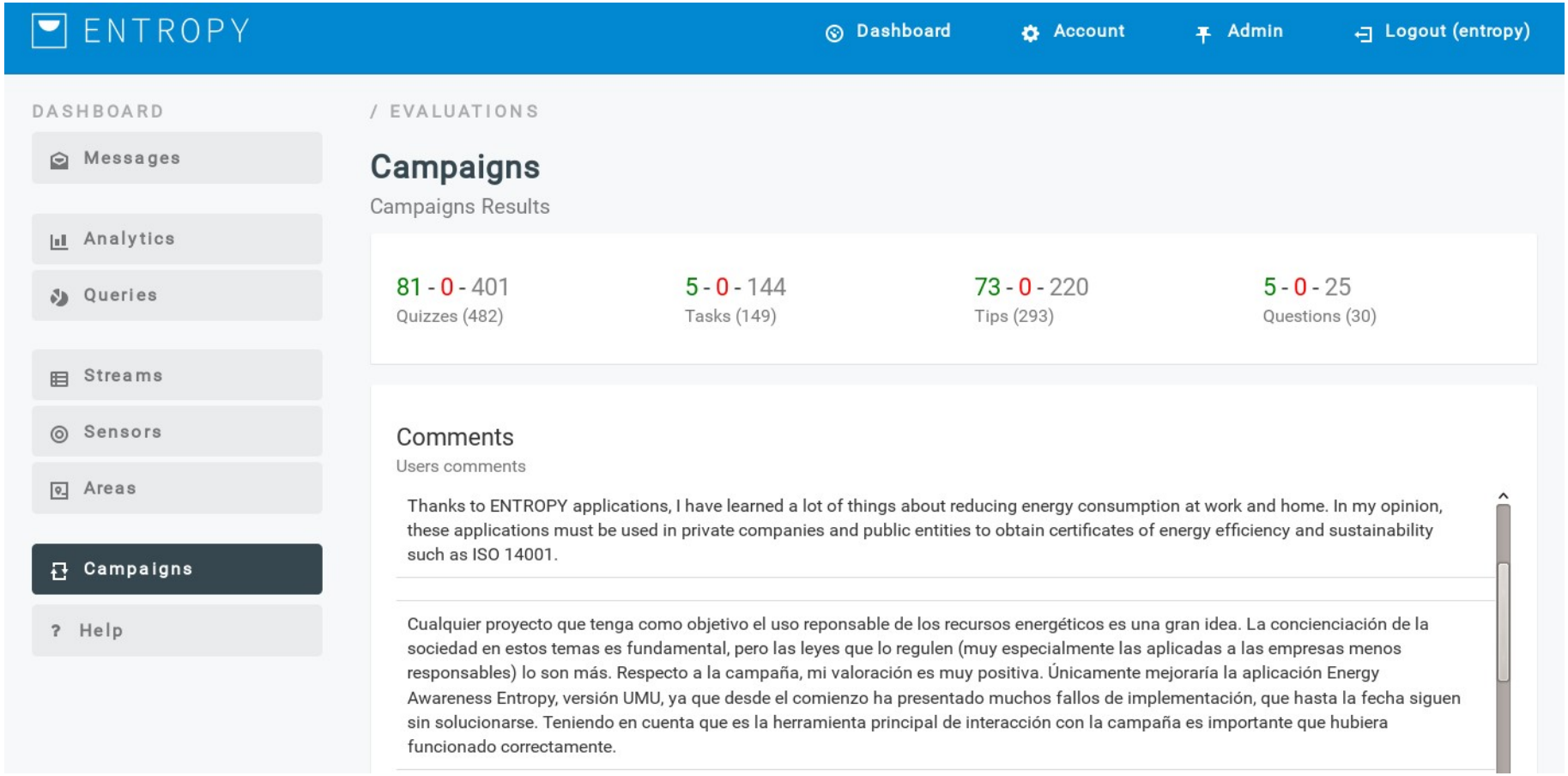

# Introduction to ENTROPY (Video)


https://youtu.be/PC5fQuXsQI4

# Thank you for your attention!

# Questions

http://entropy-project.eu/
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https://www.facebook.com/entropyproject

**Contact:**
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