FACILITY FOR LARGE-SCALE ADAPTIVE MEDIA EXPERIMENTATION

Building 5G through FLAME

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Urban Hacking in 5G

17/06/2018

Welcome to FLAME – Urban Hacking in 5G

FLAME

iT innovation

UNIVERSITY OF Southampton

HOME ABOUT US WHAT WE DO SPOTLIGHTS VACANCIES CONTACT US

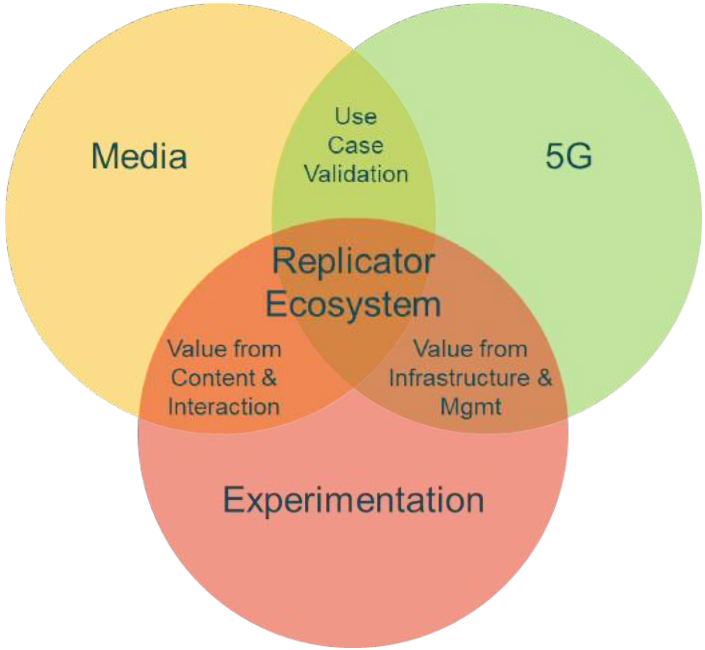
We'll cover a lot of ground

- **Convergence** across devices, clouds, networks and services and emerging **user experiences**
- Approaches to interactive media **innovation** by bring together users, technology and live events in a series of experiments conducted in real world settings
- **Analysis of** Quality of Service (QoS) to enhance Quality of Experience (QoE)

Introduction to FLAME

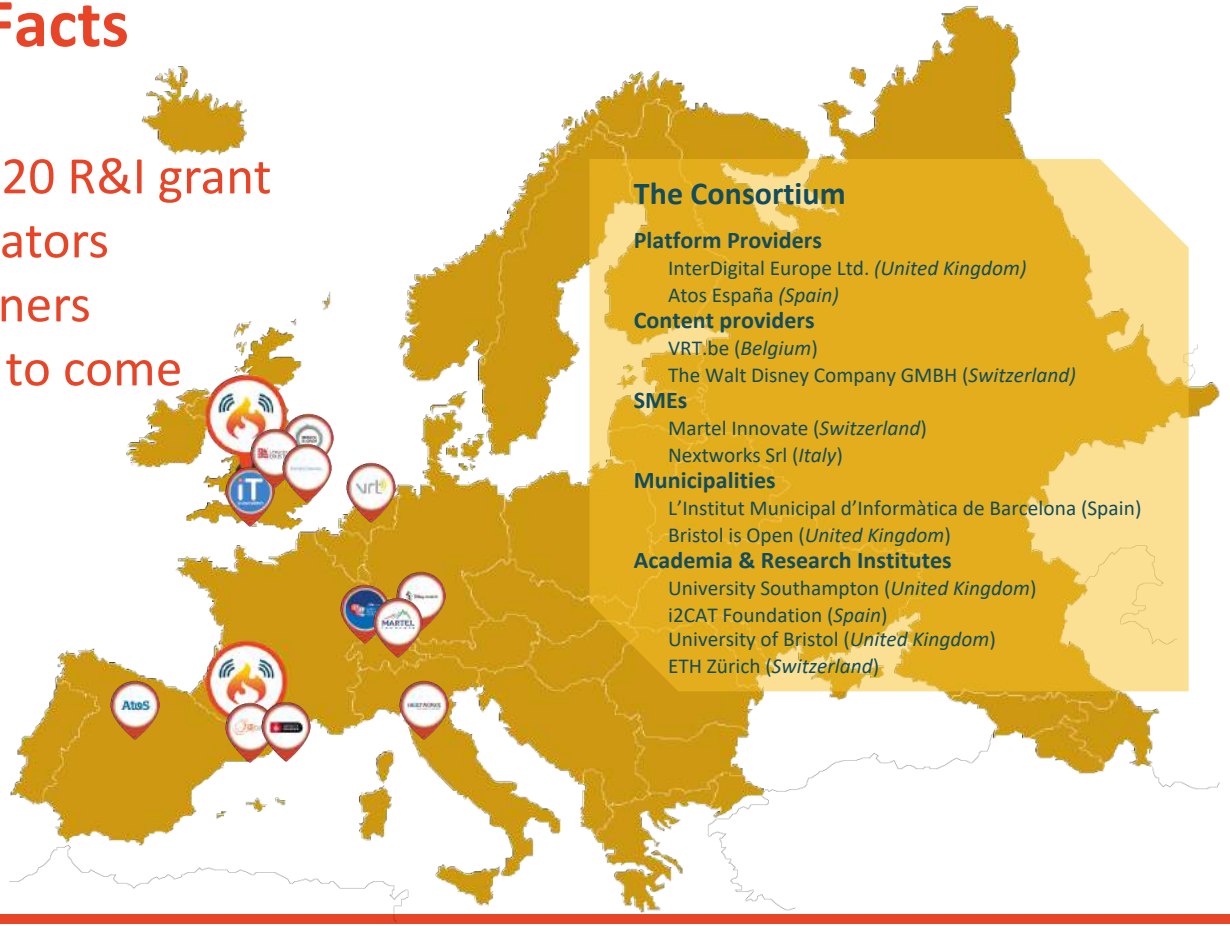
The FLAME Programme (Jan 2017- Jun 2020)

- A 3.5 year, EUR 7M H2020 project to advance the adoption of 5G for media
  - develop a ***software based 5G platform*** that sits on top of programmable infrastructures tight integration of media systems with networks
  - adopt ***advanced 5G infrastructures*** encompassing compute, storage and software-enabled communication infrastructure
  - establish an ***Future Media Internet (FMI) ecosystem*** bringing together three distinct sets of stakeholders (5G, Media and Experimentation)
  - support ***experimentation and trials of novel FMI services*** delivering outcomes to creative industries, media service providers, infrastructure providers, and beyond



FLAME Facts

- **EU** H2020 R&I grant
- **4** replicators
- **12** partners
- …more to come



The Consortium

Platform Providers
- InterDigital Europe Ltd. *(United Kingdom)*
- Atos España *(Spain)*

Content providers
- VRT.be (*Belgium*)
- The Walt Disney Company GMBH (*Switzerland*)

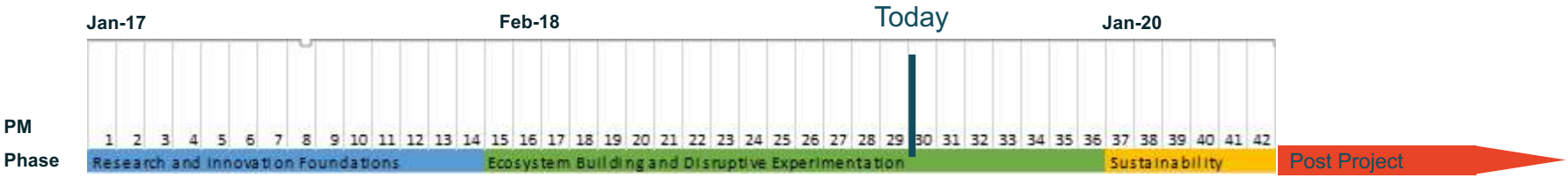
SMEs
- Martel Innovate (*Switzerland*)
- Nextworks Srl (*Italy*)

Municipalities
- L'Institut Municipal d'Informàtica de Barcelona (Spain)
- Bristol is Open (*United Kingdom*)

Academia & Research Institutes
- University Southampton (*United Kingdom*)
- i2CAT Foundation (*Spain*)
- University of Bristol (*United Kingdom*)
- ETH Zürich (*Switzerland*)

- 3.5 years
  - Jan-17 to Jun-20
- 11 Partners
  - 438 PMS
- EUR 6.9M Budget
  - EUR 2.2M 3rd party project investment

Project Phases



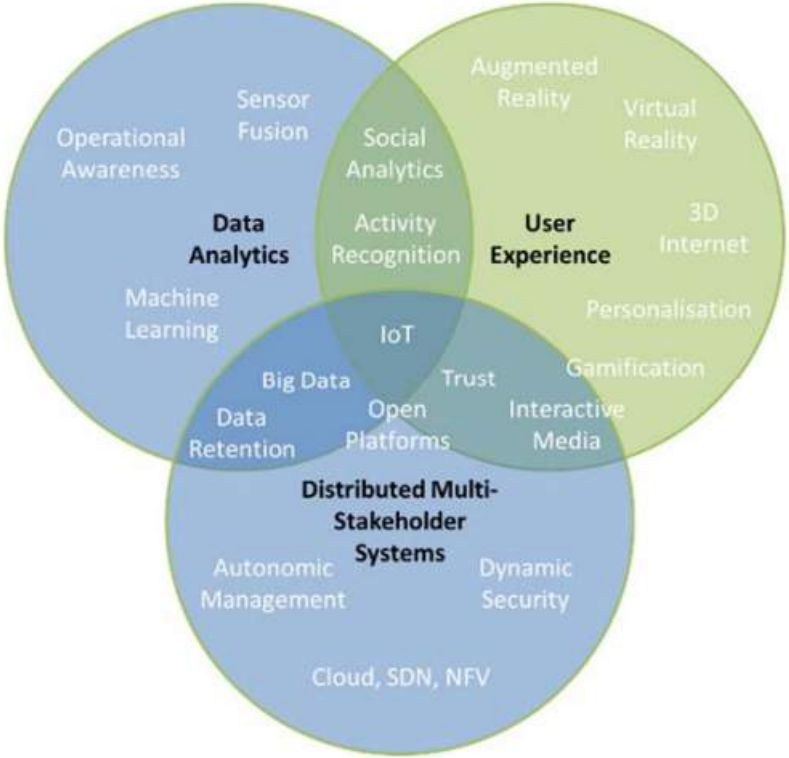
Create the FLAME capabilities to bootstrap the ecosystem

Start validation experiment, kick off open calls for 3rd party experimentation and replication projects.

Transition towards sustainability, through engagement and unfunded experiments, next stage investment and standards

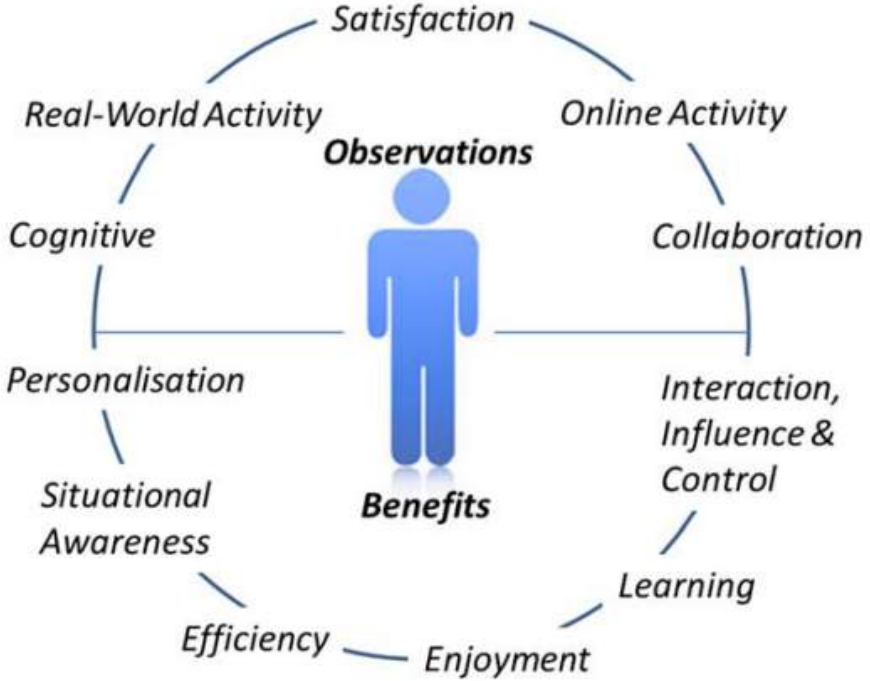
Future Media Internet

- Convergence of technologies for distributed multi-stakeholder systems
  - changes the way multimedia systems need to produce, deliver and consume content
- Systems must create value by linking people to each other and to locations (both real and virtual)
  - capture the popular imagination
  - address desires of consumers to share their experiences



Users at the Heart of the System

- User centricity is a critical for design and development of multimedia systems
- Two main principles in our user centric design processes:
  - users are the primary beneficiaries, and other benefits to providers of services and technology will follow from user benefits
  - users who participate in observations are also those same users that realise the primary benefits
- Principles reflect the shift towards the democratisation of Internet services
  - users play a greater role in generating information
  - need to recognise explicitly the cost and benefit of participation

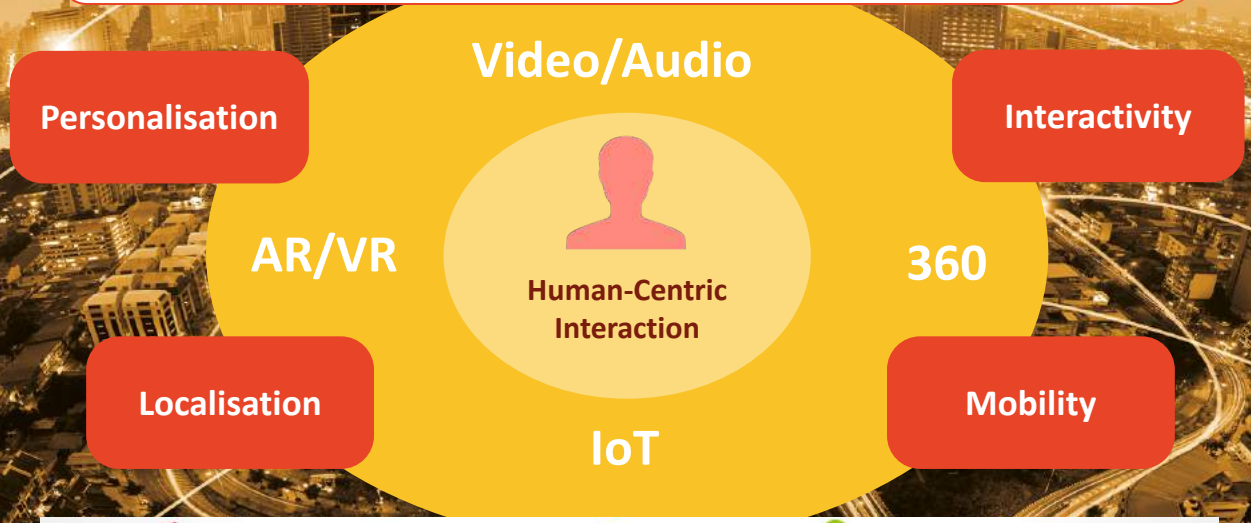


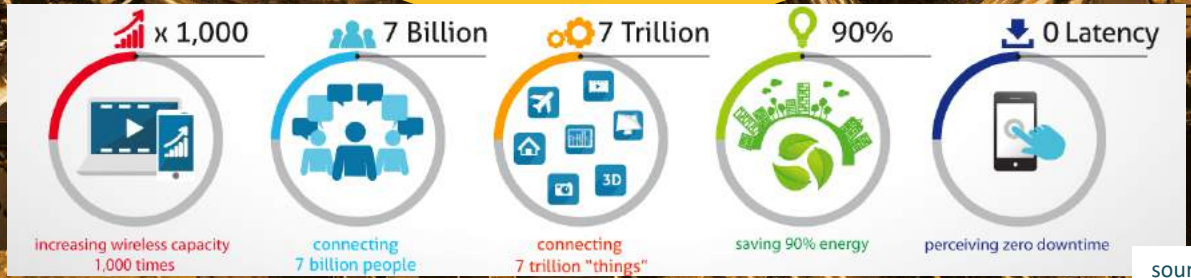
IoT= Wearables

Future Media Internet - Experiences

- Enhanced personalisation
- Non-linear story-telling
- Interactive immersive experiences
- Social communities which allow people to use 3D environments to communicate and interact with each other
- Capture and reproduction of the real world in 3D
- Creation of perceptual congruity between real and virtual worlds

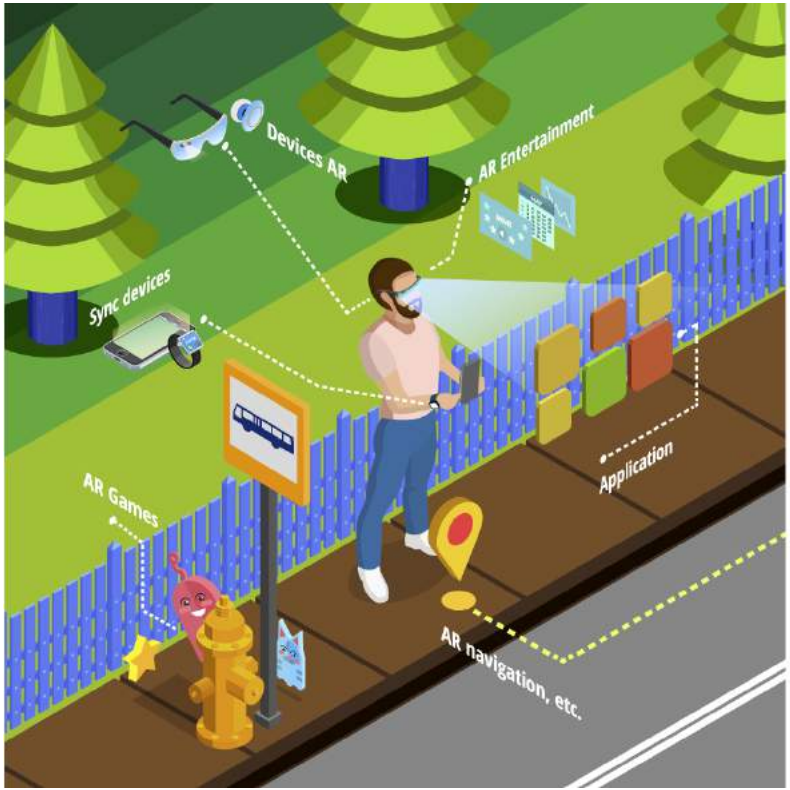
Media Scenarios





source: www.5g-ppp.eu

Real-Life Media Scenarios



The Invisible Infrastructure?

Over-the-top content (OTT) refers to delivery of audio, video, and other media over the Internet without the involvement of a [network] operator in the control or distribution of the content

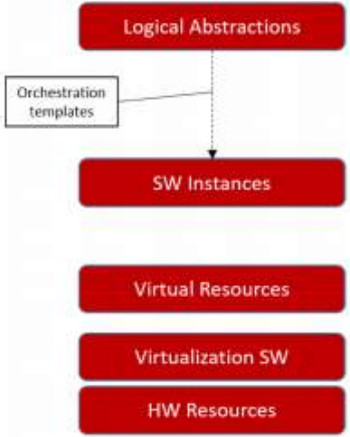
Current Online Media Services

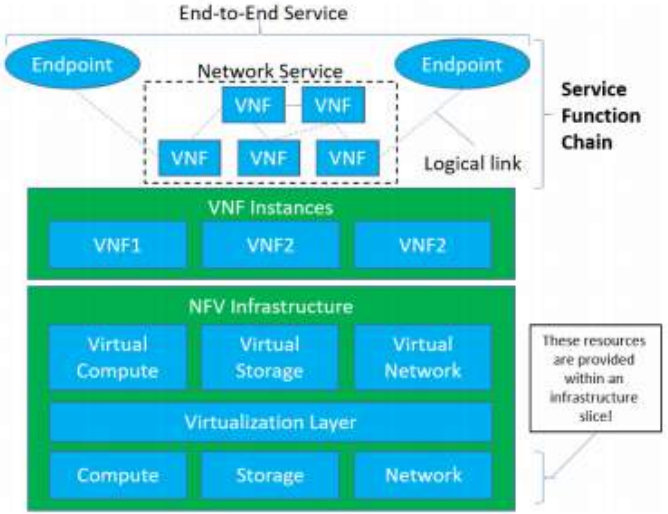
source: ottsource.com/ott-blog

Future Online Media Services

Future Media Internet - Infrastructures

- Applications place significant demands on network and content management infrastructures
  - delivery of Quality of Service and enhanced Quality of Experience
  - communities that dynamically organise themselves around socially distributed, fixed and mobile content
- Software defined compute, storage and communications infrastructure
  - increasingly distributed including the mobile edge



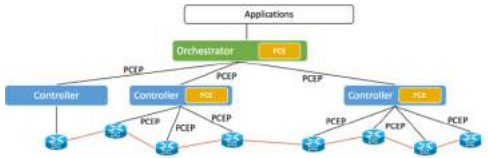


Future Media Internet : Tighter integration of media services and distributed infrastructures

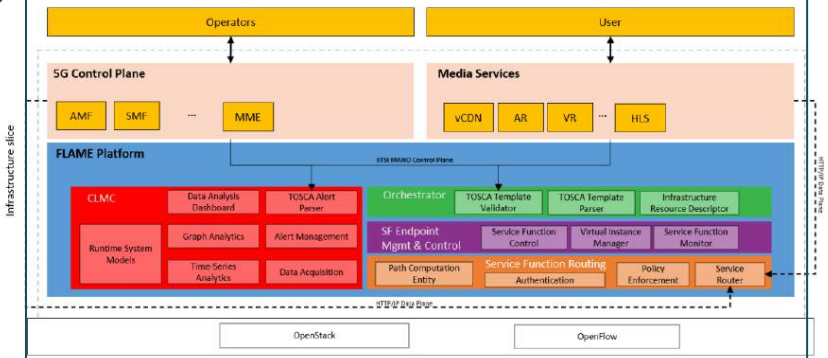
FLAME

Media Applications and Services

Distributed Software Defined Infrastructures including mobile edge



FLAME



Approach

FLAME is developing a **software based 5G platform** that sits on top of programmable infrastructures, improving media delivery to end users

The platform allows for flexibly controlling the provisioning of content and services with the ultimate vision of the service ‘just being one hop away’

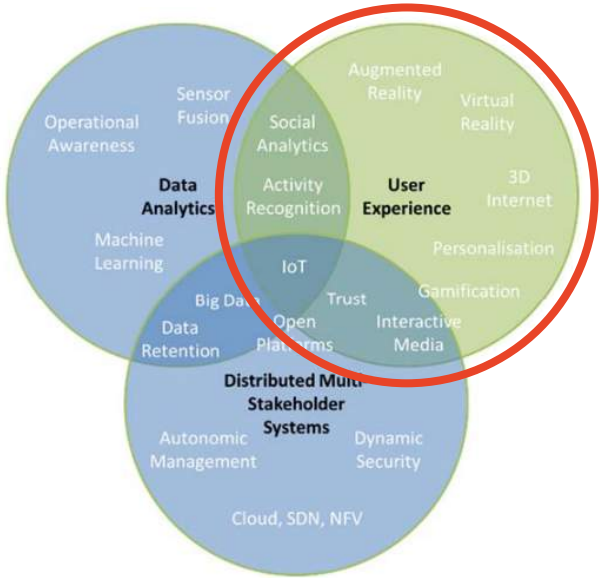
For citizens this means:

- **Better performance and lower costs** through efficient network mechanisms
- Access to **new services offerings** that exploit personalisation, interactivity, mobility and localisation
- **Easier collaboration** with other people on the network
- Enjoy the Internet through simply installing an **application** on their phone

We say….

It’s important to investigate what 5G will be used for

…..not just how it will be operated



What kind of user experience?

Schladming Ski Resort, Austria

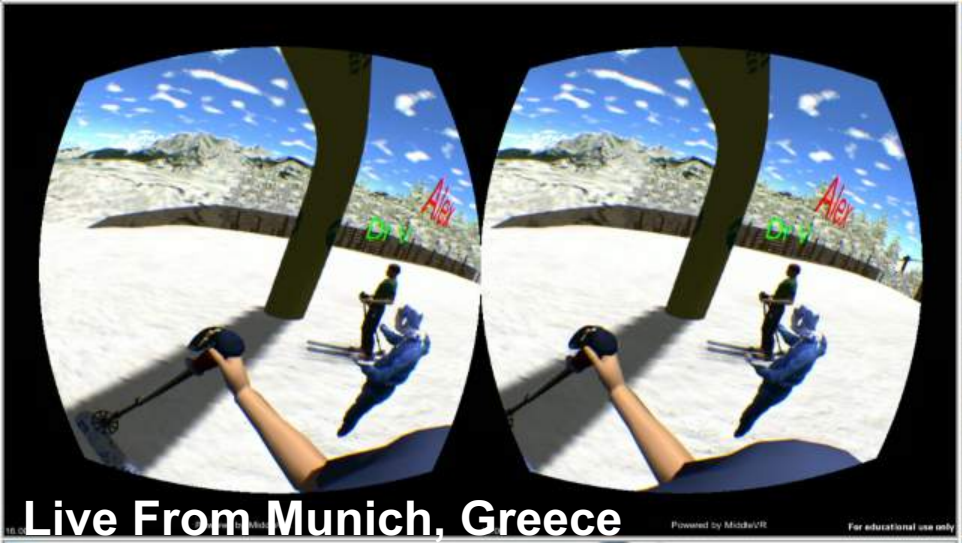
Super G World Cup Night Race

27 Jan 2015

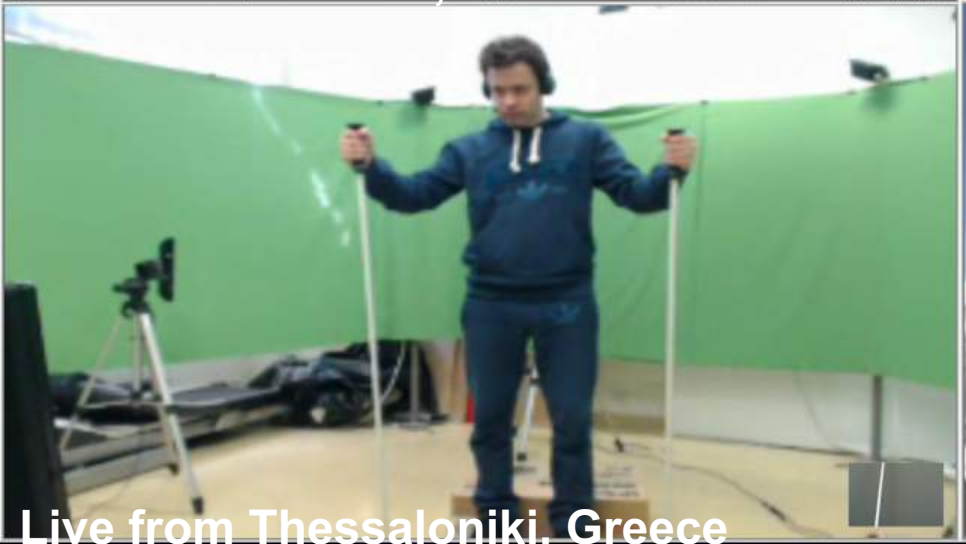
World's 1st Mixed Reality Ski Race

2-3 Feb 2015

Let’s see the action - BBC Click



Live From Munich, Greece



Live from Thessaloniki, Greece

Live from Schladming, Austria

Outside gear

Controller

Smartphone

Inputs

- Real GPS Location
- Biomechanics
- Environment conditions
- Game control
- Voice and Background Sound

Smart Data Goggles

Outputs

- Player voices and Game Sounds
- Augmented slope scenes
- Virtual player location
- Online competitor locations
- Online player's movements

Inertial Senso

Environment Sensor

Headphones

Inside gear

Oculus Rift, CAVE

Ski Simulator or Wii Fit

Inputs

- RT 3D reconstruction of players
- Activity recognition
- Voice

Outputs

- Player voices, Game Sounds, Real Sound
- Immersive 3D environment
- Virtual player location
- Real and Online competitor locations
- Reconstructed 3D online players

1 to 4 Kinect Sensors

Laptop

Worlds 1st Mixed Reality Ski Competition 2-3 Feb 2015

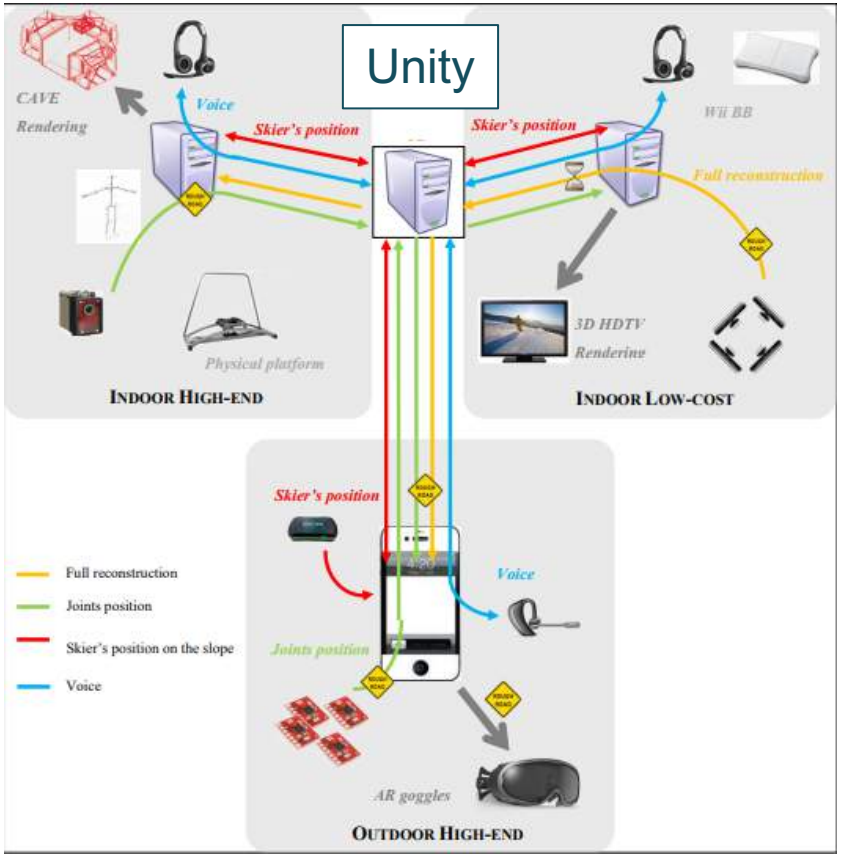
Results	R1	R2	R3	R4	Total
Alex	3:15	2:25	2:58	1:23	**10:01**
Ben	2:58	2:56	2:57	1:32	**10:23**
Dr V	2:40	3:45	3:21	1:35	**11:21**

Final Result

3D live

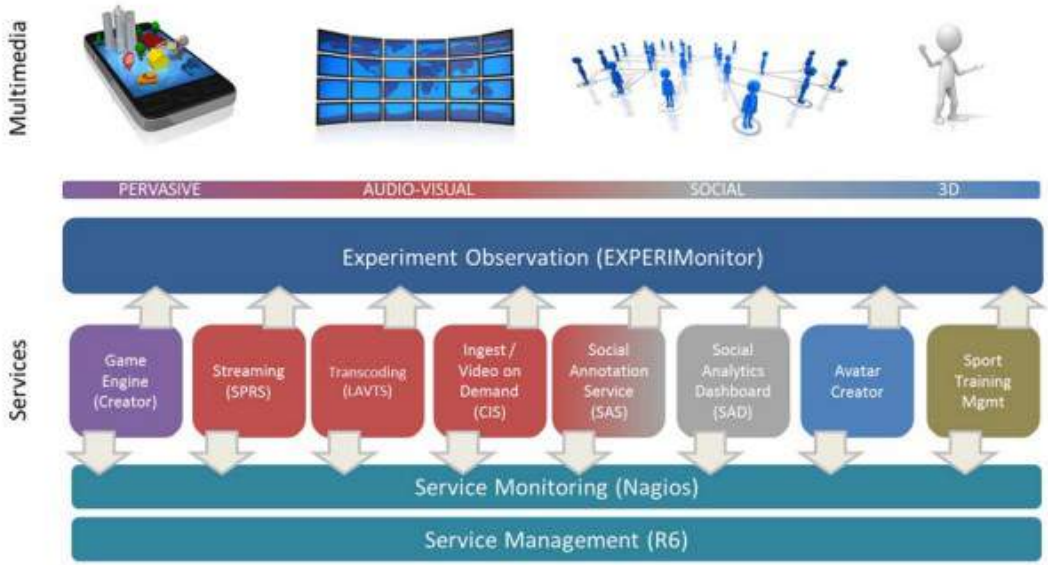
3D Live Challenges

- Research challenges
  - Rendering and visualisation
  - Activity recognition
  - 3D reconstruction in real-time
  - Data compression and transmission



EXPERIMEDIA – Media Cloud Platform

Cloud services that combine **social networking with media production and delivery technologies** *for trials that explore new forms of* ***social interaction and experience between online and real–world communities***



https://eprints.soton.ac.uk/374078/1/374078.pdf

EXPERIMEDIA

Venues

Sports Training and Science @
CAR High Performance
Training Centre

Cultural Learning @
The Foundation of
the Hellenic World

Outdoors And Leisure @
Schladming Ski
Resort

FLAME

EXPERIMEDIA

Anywhere!

GLASGOW 2014 XX COMMONWEALTH GAMES

Laval Golf LA MAYENNE

Oulu Capital of Northern Scandinavia

2014 world rowing championships

Live Real-World Events

adaptive scaling for large-scale short-lived communities

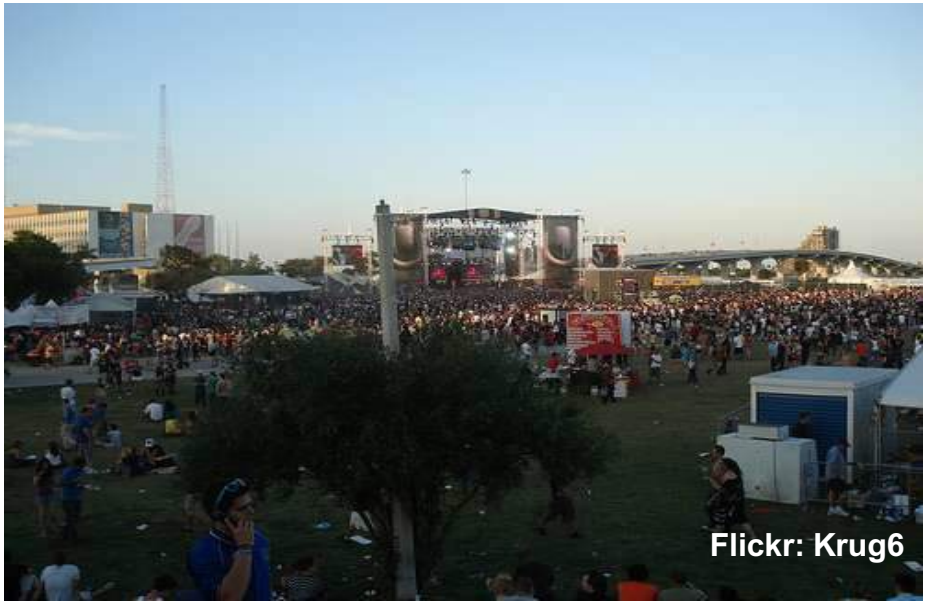
adaptation to environment considering physical, social and ethical constraints

adaptation of content according to individual and/or group preferences

Live Real-World Events

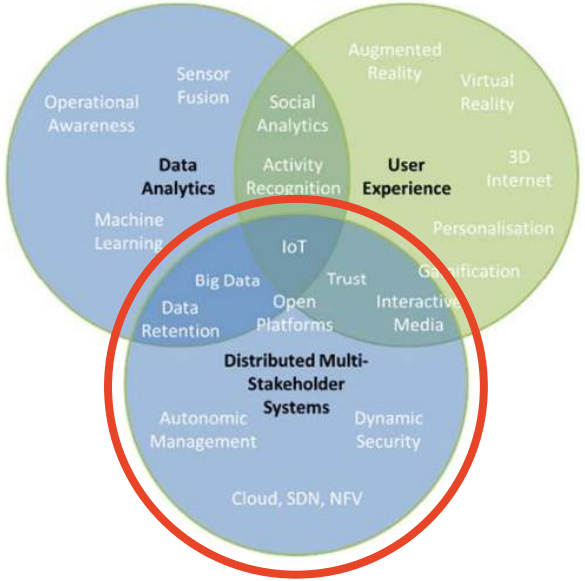
real-time orchestration allowing for ***adaptive narratives***

adaptation to unreliable sensors and devices for detection and tracking of feature points



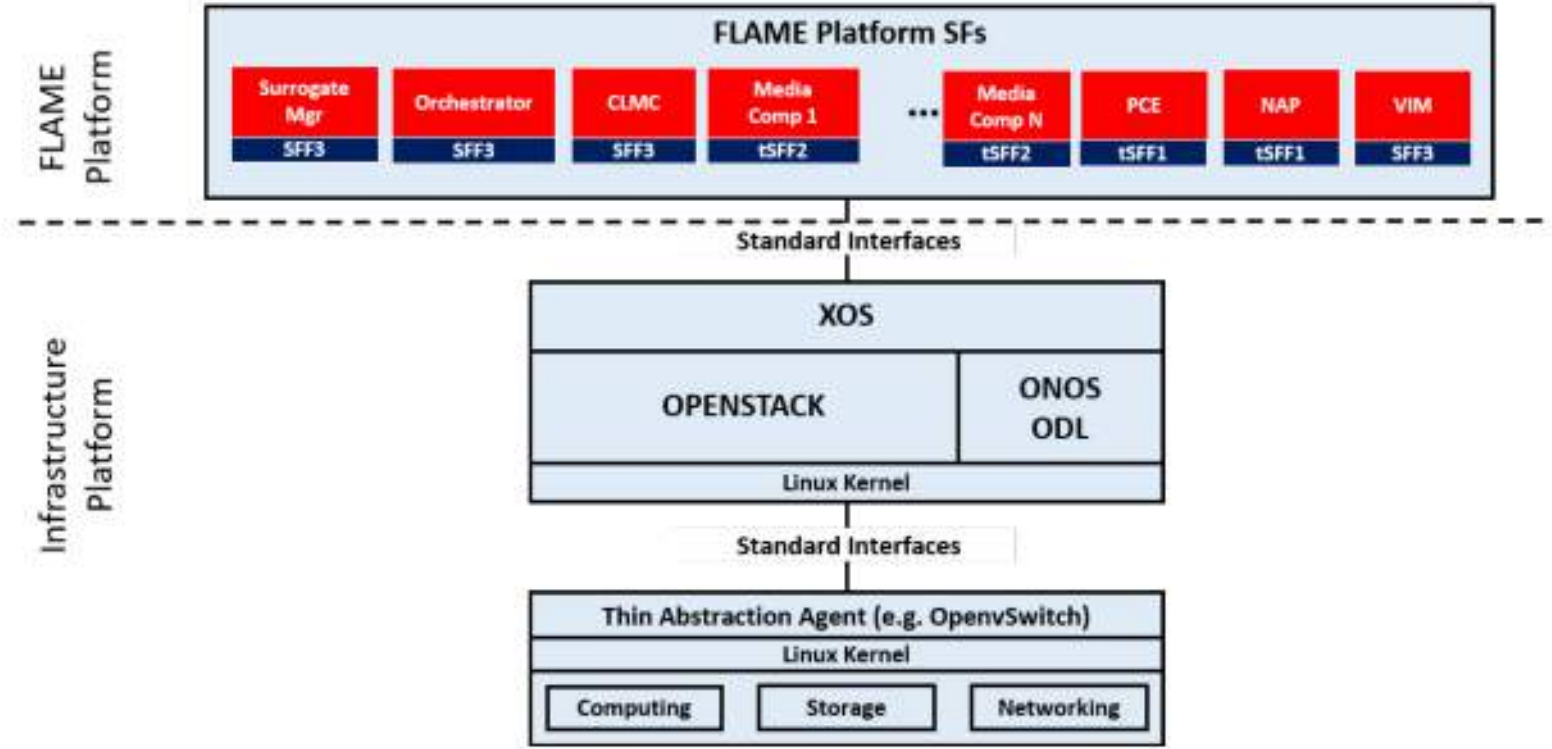
adaptation to device capabilities both remote and at a venue

adaptation to cooperative or collaborative frameworks including dealing with selfish or malicious users

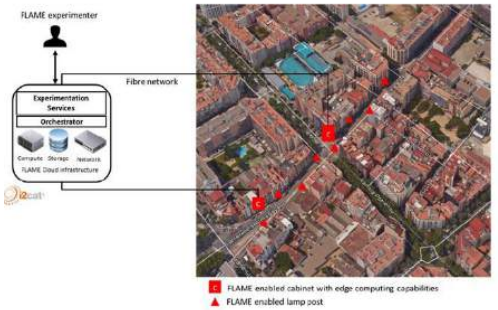


What's happening to the infrastructure?

Infrastructure-as-a-Service



Real Life Infrastructures



Compute resources distributed and integrated with communication infrastructures across real-life infrastructures (edge, metro and core)

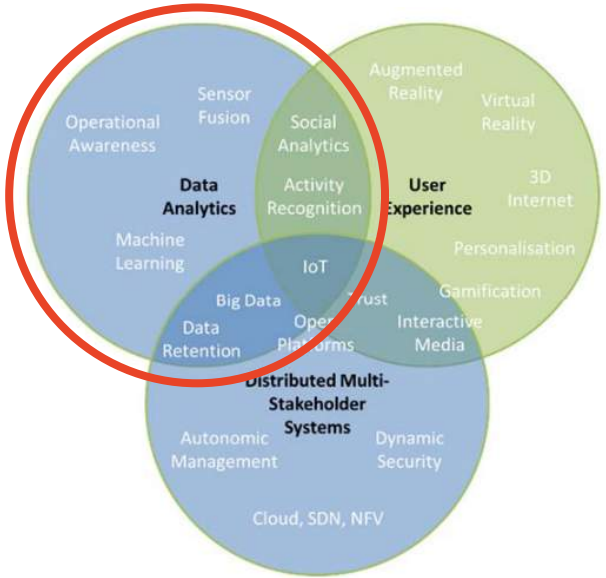
FLAME IaaS specification for mobile edge computing and software defined real-life experimental infrastructures

Bristol | Barcelona | European City A | European City B | European City C

FLAME Trailblazing Infrastructures

3rd Party Investment in FLAME Replicator Infrastructure Projects

Experimentation-as-a-Service (EaaS) Sustainability and Governance Models



What's happening to the analytics?

Experimentation

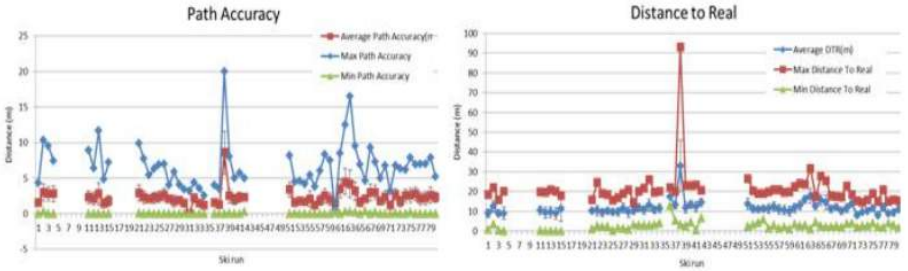
- We are doing future media internet **experiments**
- What do you want to know?

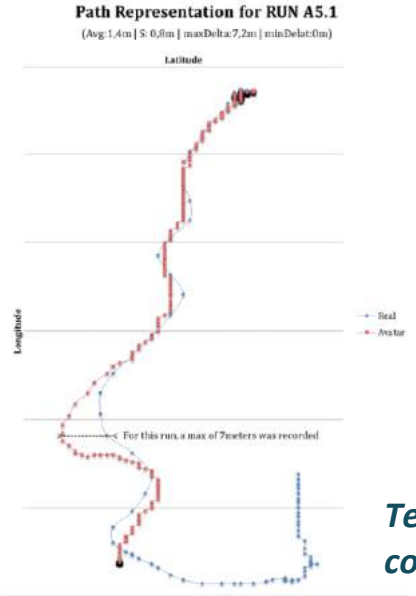
If you can't measure it then
you do not know what is going on

- Did people like it? — QoE
- If not, why? — QoS
- Were there technical problems? — QoS
- Did that matter? — QoE

Quality of Service

- Commitments from service provider to customers
  - part of Service Level Agreements
  - can be infrastructure, platform or service specific

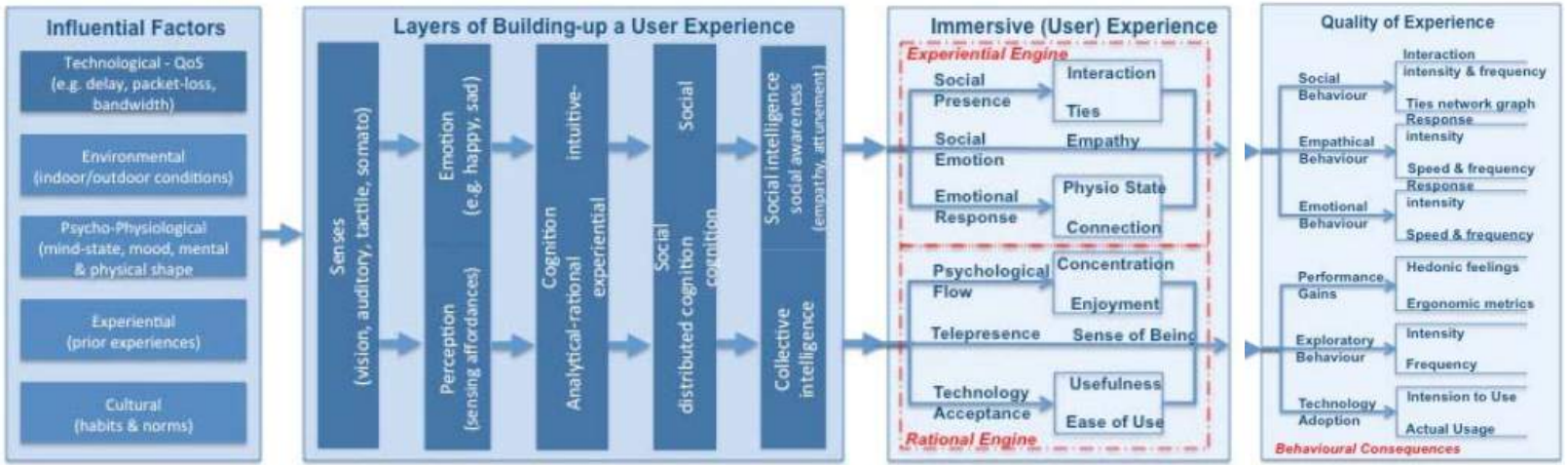




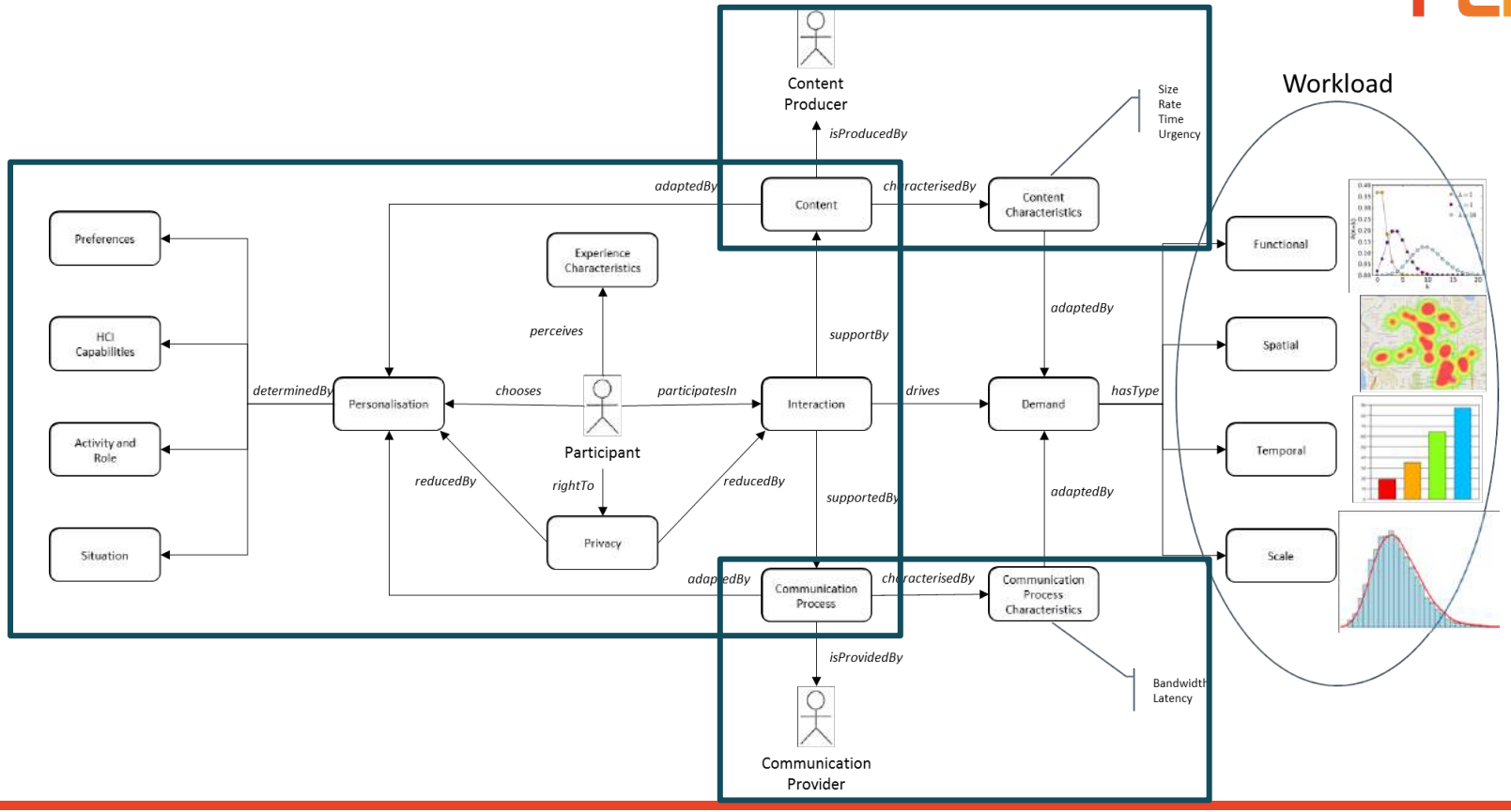
Temporal and spatial consistency

Quality of Experience

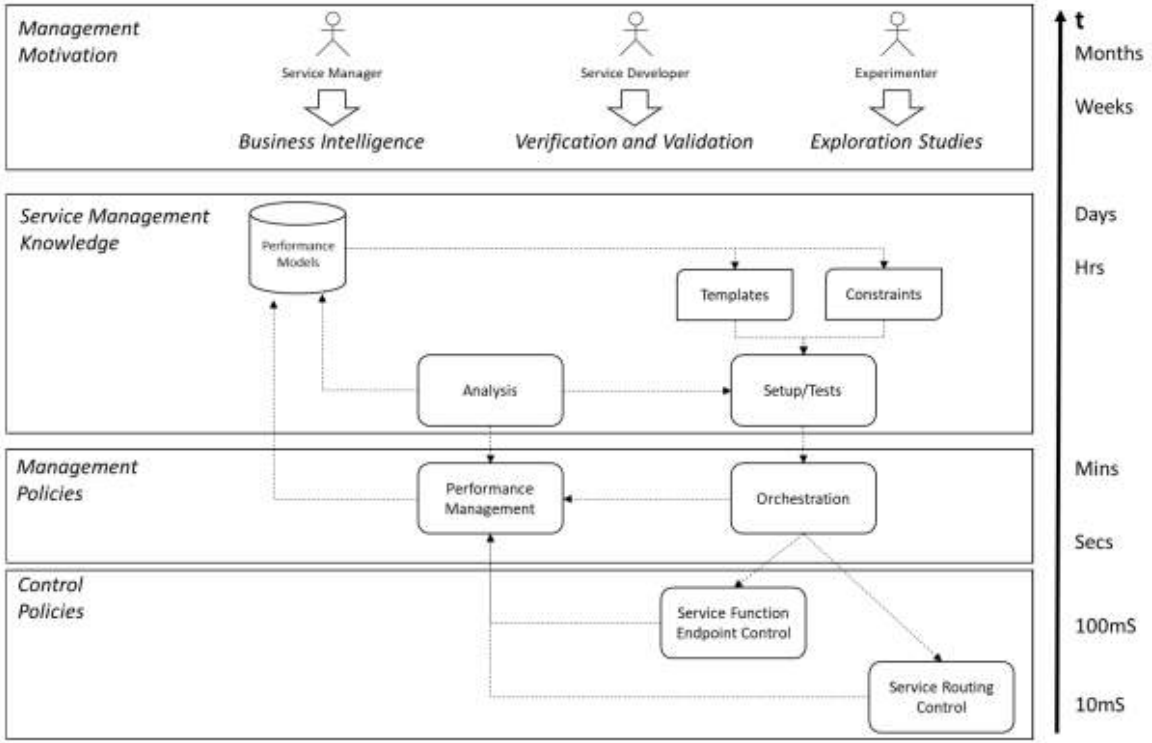
- Complex concept and not easily defined because it is composed of many elements
  - no singular, definitive definition of QoE
  - often viewed as a network of inter-related aspects that connect a person to the world via interactive experiences, highly contextualised
- Measured technical QoE (e.g. quality of content) vs subjective QoE (e.g. satisfaction)



Demand (PIML) -based System Characterisation



Knowledge for Platform Management and Control

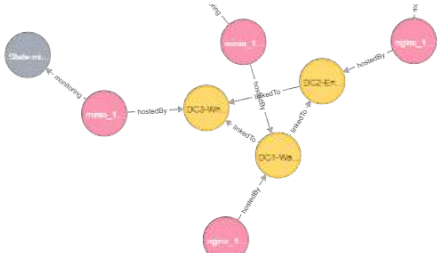


Cross Layer Monitoring and Control

User Demand: personalisation, interactivity, mobility, localisation

Cross-layer multi-dimensional data analysis

- time-series data collection and aggregation
- temporal cross-layer graph analysis



Media service template (TOSCA) modelling and evolution

User Acceptance & Viability of PIML-Oriented Media

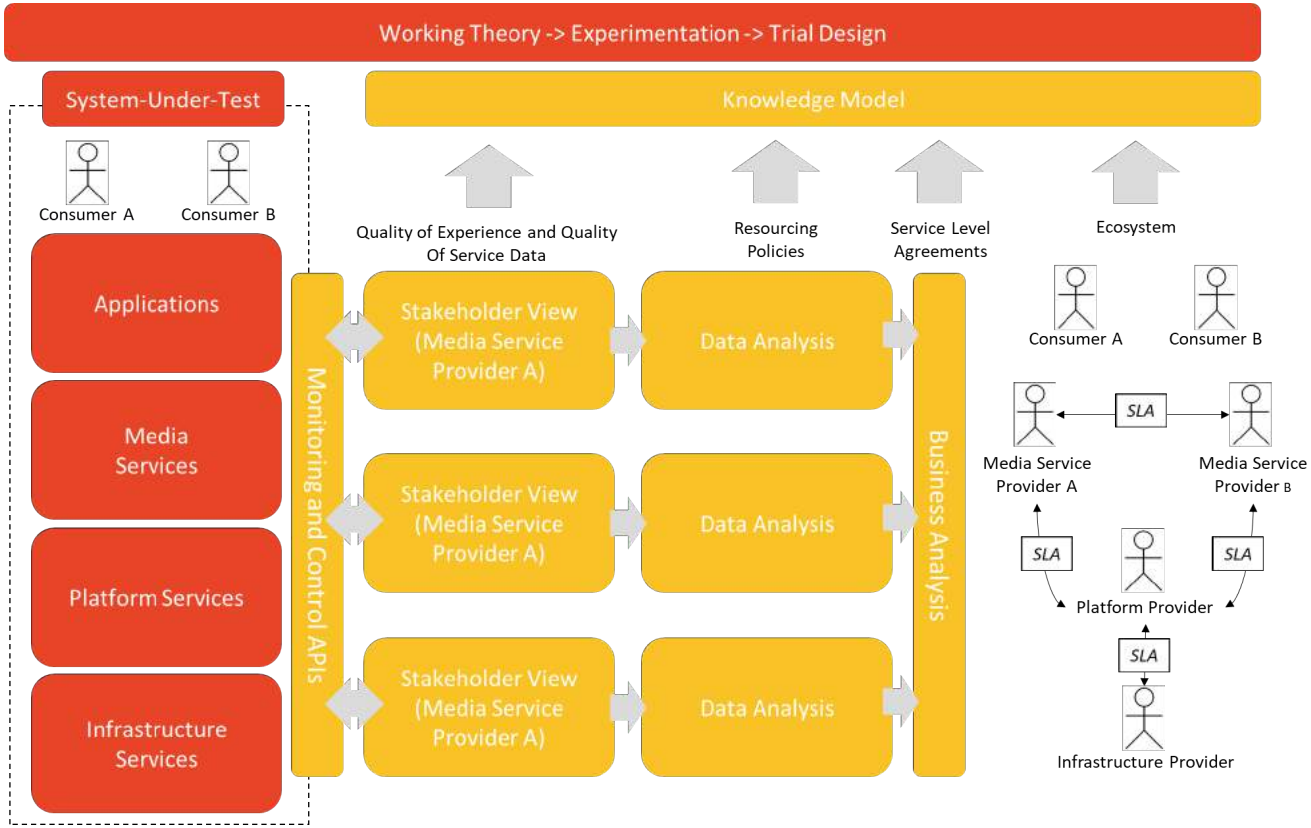
FMI Performance Knowledgebase

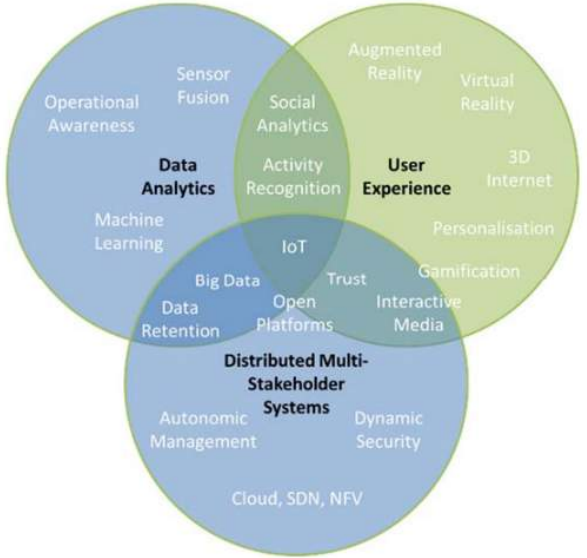
Infrastructure Utilisation & KPIs

Socio-Economic & Technical Insights

Infra Resource: spatial-temporal allocations, usage, performance

Multi-Stakeholder Trials and Experiments

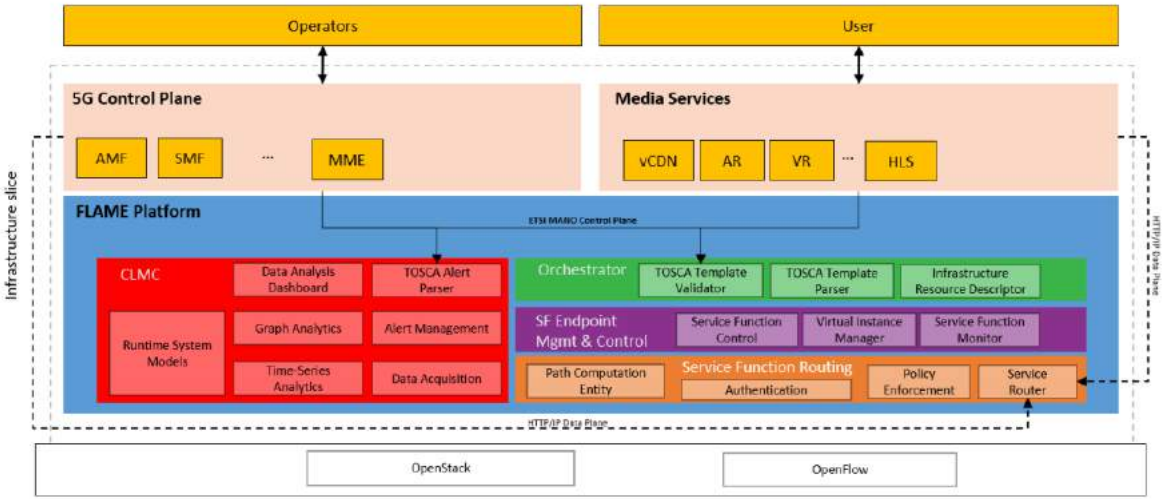




FLAME: Tighter integration of media services and infrastructure

The FLAME Service Delivery Platform

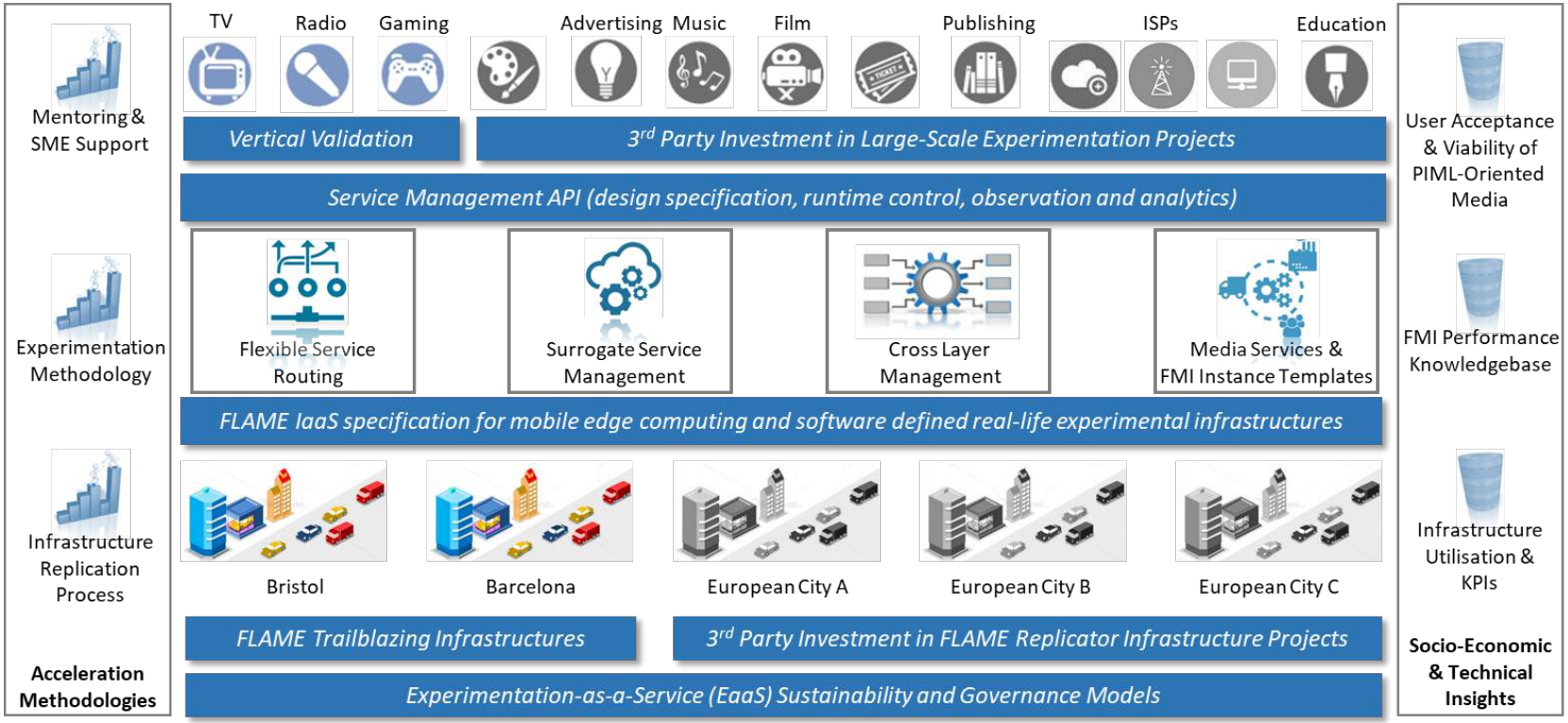
- **A new dynamic content production and delivery platform based on 5G network technologies**
  - layered modular architecture with cross layer optimisation, analytics and control
  - distributed computing models that combine media cloud with mobile edge
  - NFV-based orchestration with SDN-based network
  - Integrated with multi-RAT environments
- **Supporting enhanced Quality of Experience**
  - personalised, interactive, mobile and localised media services



Validation through Urban Scale Trials & Experiments

- Validate platform capabilities by trials conducted by ecosystem partners
  - 5 operator infrastructures
  - 25+ customer trials
- New media formats (AR, VR, 360) and distribution channels
- Engagement with media service providers, content providers, infrastructure operators and beyond
- Trials will be conducted in 3 waves from Mar-18 to Jun-20
- Public funding available through H2020 FLAME project

FLAME Overview



VIRTUAL REALITY

Conclusions

- Interactive media systems will be increasingly transformed by:
  - continuing convergence of infrastructure technologies
  - increasing availability of data from IoT platforms and Big Data

- Benefits must be driven by users at the centre of design processes
  - Creative experience designers have a major role to ensure that the data can be turned into enhanced experiences and sustainable data value chains
  - Developers must be given the tools and APIs to exploit the availability of infrastructures for optimal distribution of socially distributed content

- FLAME brings all of these stakeholders together to explore the acceptance and viability of future media internet systems
  - You will see this week at the hacking event

FLAME Online

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