FACILITY FOR LARGE-SCALE ADAPTIVE MEDIA EXPERIMENTATION

Insights into Early 5G Deployments

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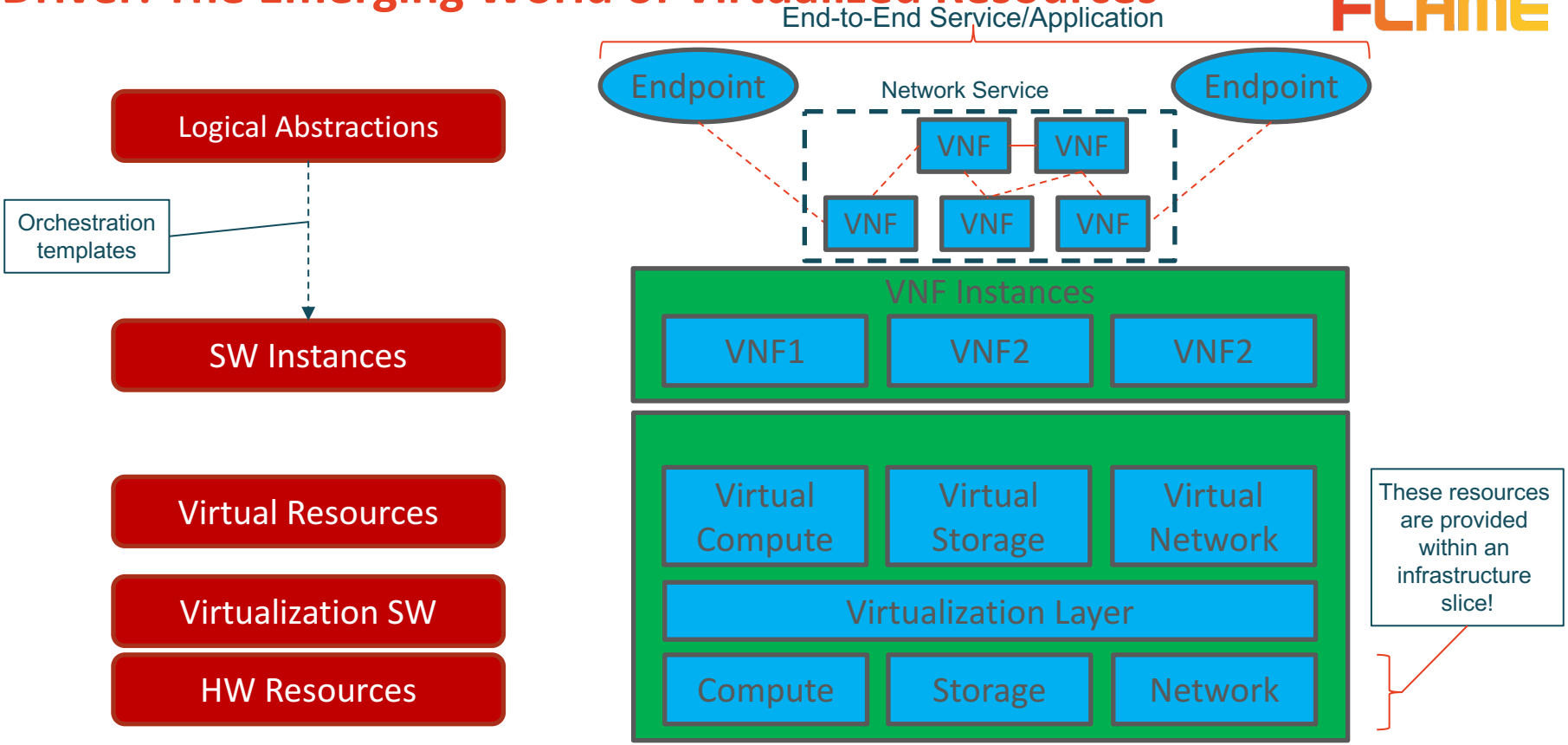
Driver: The Emerging World of Virtualized Resources



Approach

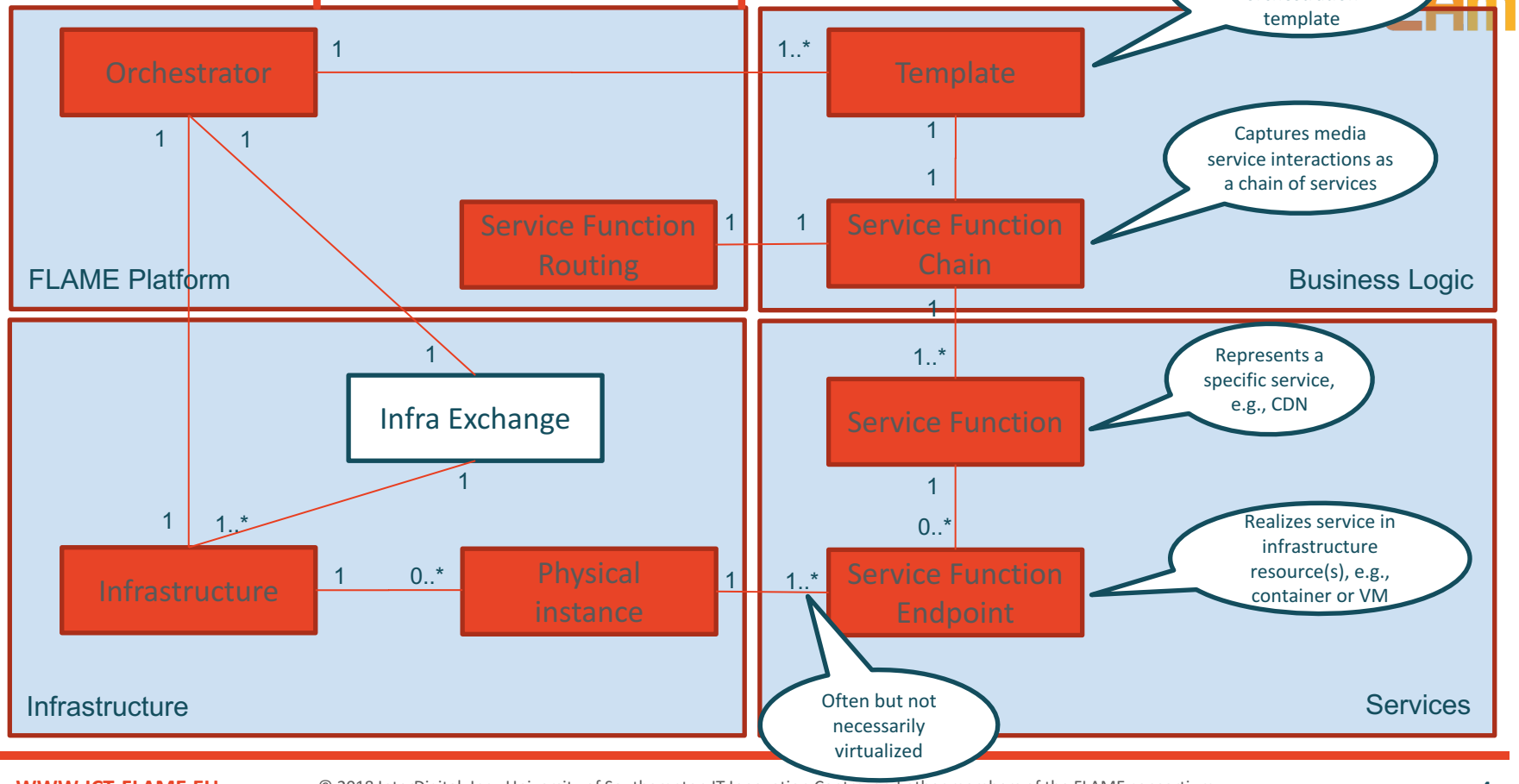
FLAME is developing a **software based 5G platform** that sits on top of programmable infrastructures, improving media delivery to end users

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:

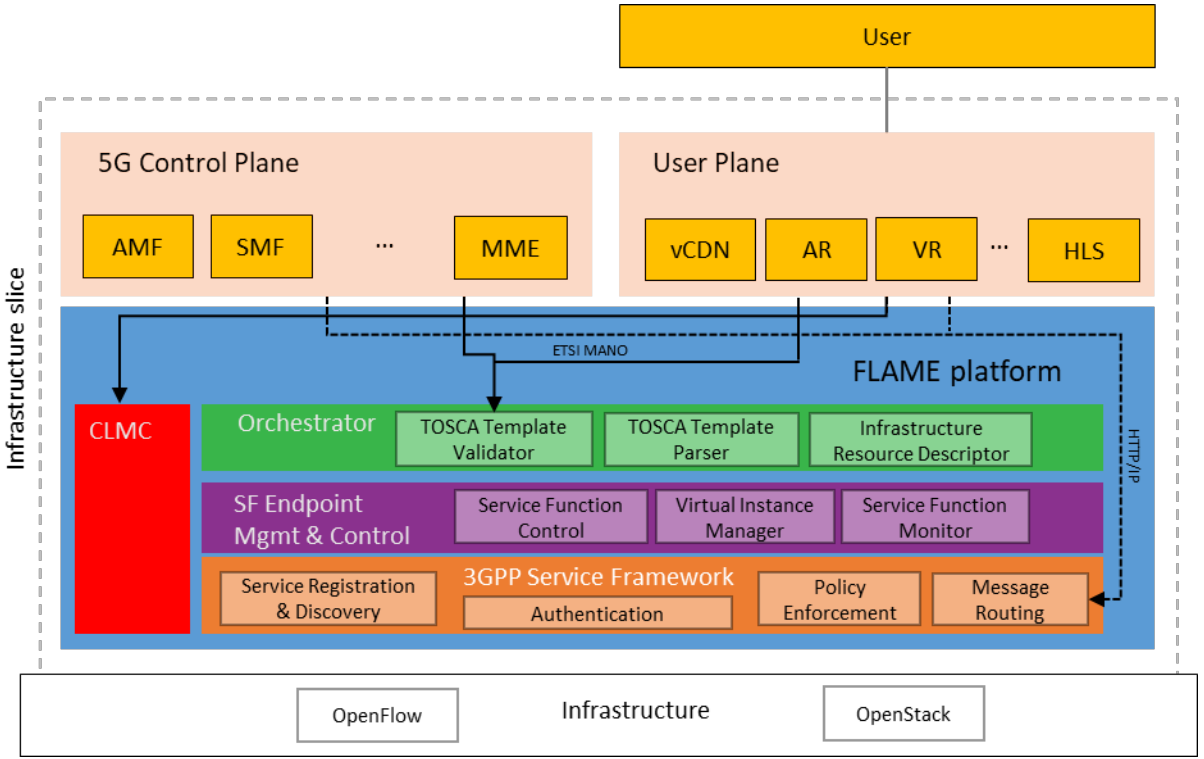
- **Better performance and lower costs** through efficient network mechanisms
- Access to **new services offerings** that exploit personalisation, interactivity, mobility and localisation
- **Easier collaboration** with other people on the network
- Enjoy the Internet through simply installing an **application**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

Basic Concepts & Relationships



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
  - Aligned with 3GPP Rel16 work on service-based architecture
- **Supporting enhanced Quality of Experience**
  - personalised, interactive, mobile and localised media services



Technical Proposition

FAST, ADAPTIVE

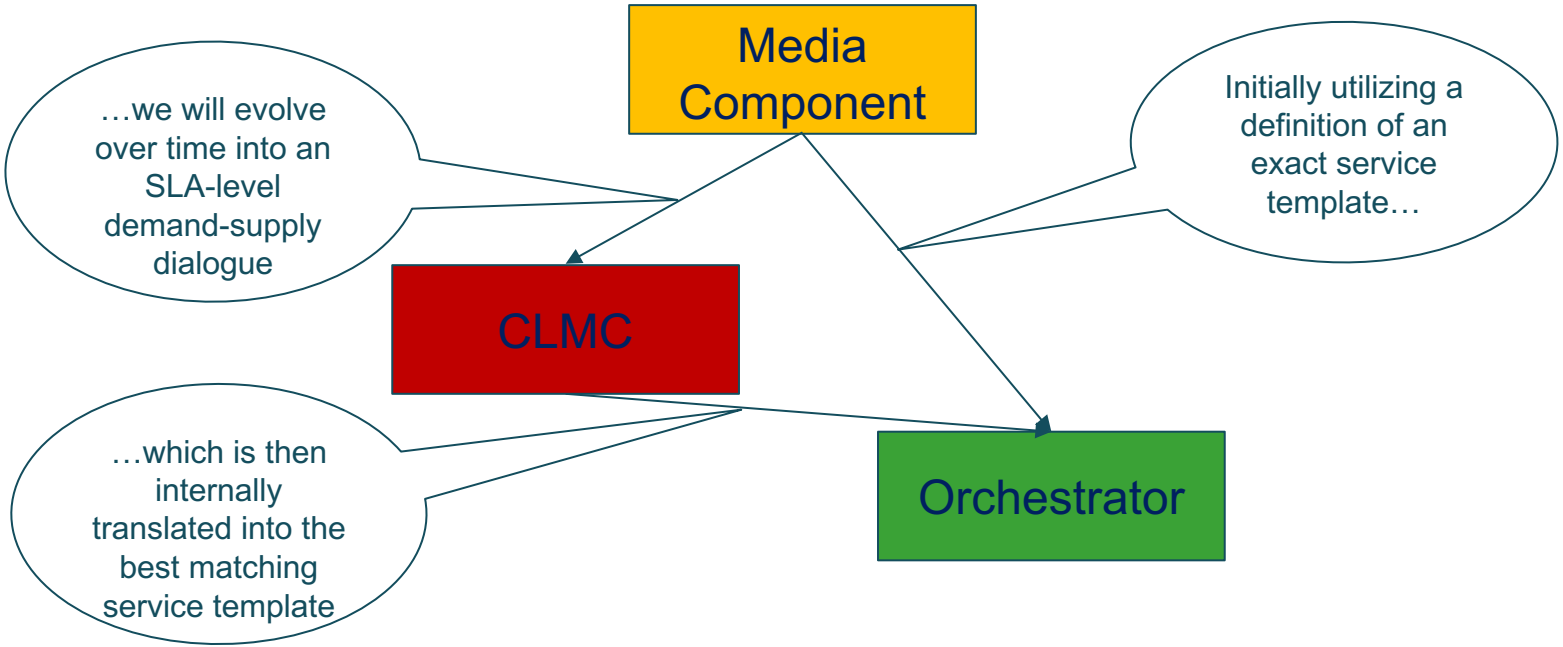
- **Faster response, better engagement**
  - service deployment at the edge of the network (e.g. in a street cabinet)
  - compute located just one hop away (at best) from the users, low latency access
  - compute workload distributed across the network
- **Improved service request routing**
  - fast (between 10 and 20ms) switching time from one service instance to another by not relying on the DNS.
  - overcomes inefficient ‘triangular’ routing of requests in current IP networks
- **Multicast delivery of http responses**
  - multicast-based delivery of HTTP responses to service request transparently to the (otherwise unicast) semantic of HTTP transactions.

ROBUST, SECURE

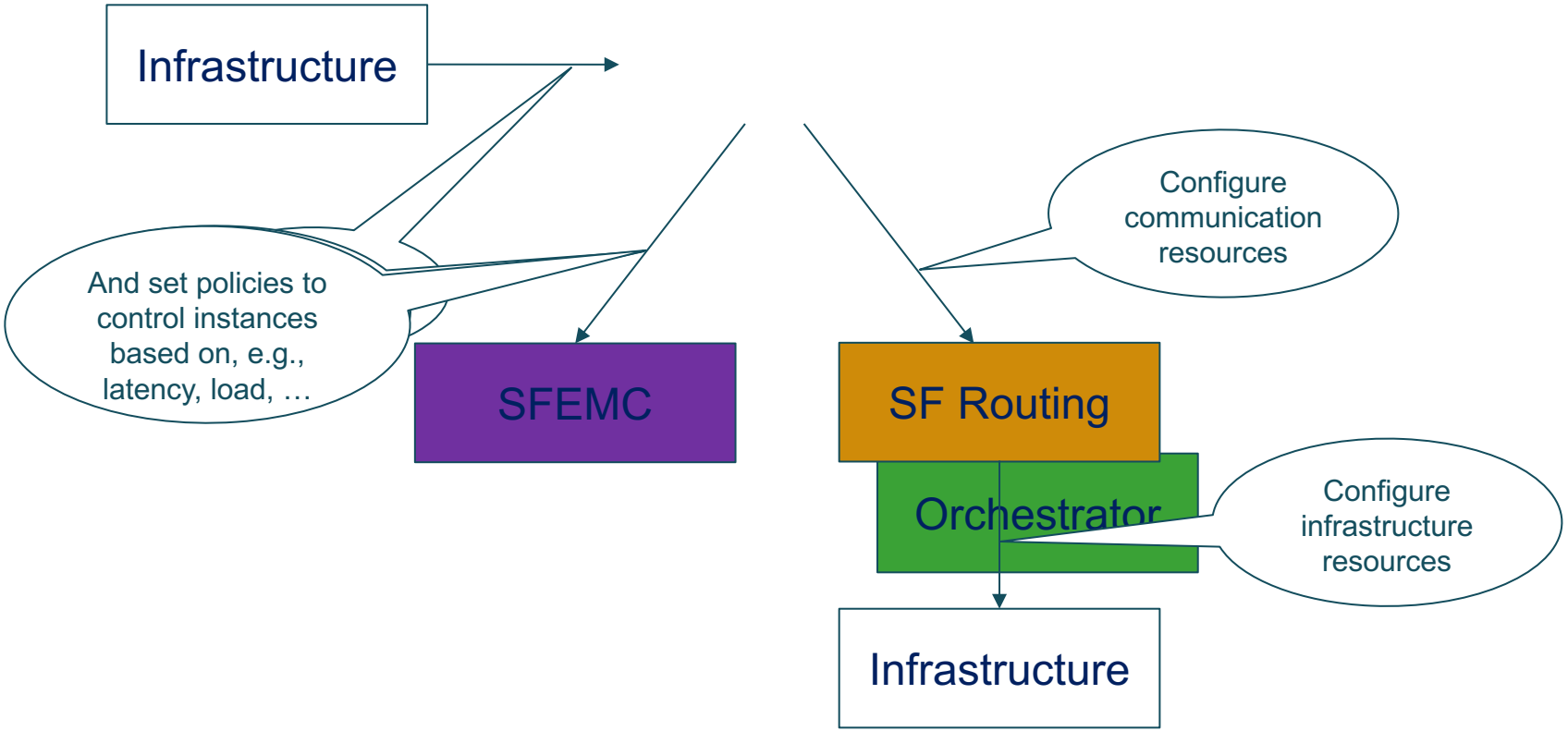
- **Net-level indirection**
  - indirection of service requests at the network level allowing error response to redirect the original request to another alternative surrogate
  - nesting operations leads to a net-level ‘search’ among all available surrogate instances
- **Less chance of insecure direct object references**
  - CDNs morph into surrogate service endpoints with the potential to hold the necessary security context when serving the desired content
- **Secure end-to-end access to content**
  - CDNs deployed as properly secured endpoints with the necessary certificate sharing between content
  - Securing content delivery according to the originally intended end user facing contract -more secure for provider and consumer.

…achieved through a unique cross-layer information approach

An Increasingly Rich Dialogue between Experimenter & Platform



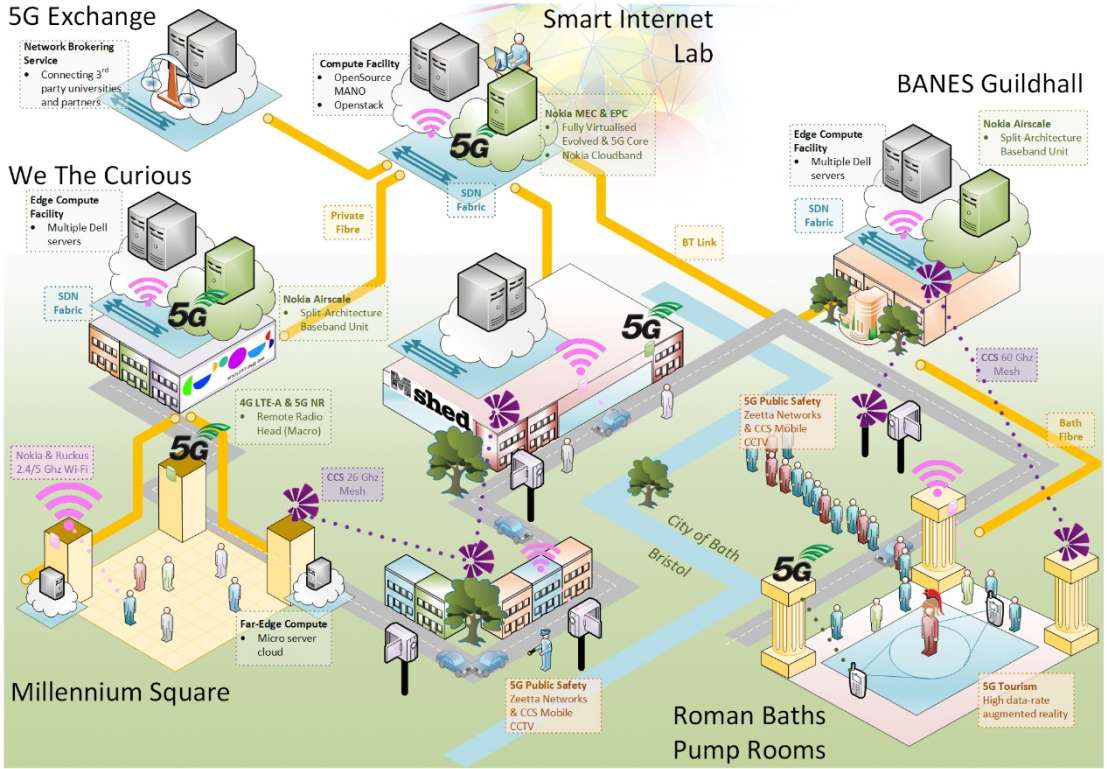
Supported by Flexible Management and Control



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 Dec-19
- Public funding available through H2020 FLAME project

Deployed Across Two UK Cities for Large-Scale Trials in 2019 in 5G Smart Tourism



Technology Highlights

- Multi-RAT
  - 5G NR & 5G mmW
  - LTE-A
  - Wi-Fi
- Micro-data centers in
  - Roman Baths & Guildhall
  - We The Curious
  - Smart Internet Lab

  providing MEC services
- Use cases in guided VR tours, AI-assisted image recognition & public safety

Example Use Case

- Three users watch a virtual reality stream in two locations
  - Users are somewhat synchronized in viewing
- Bristol (UK) trial in Jan 2019 will showcase a scenario where stream is controlled by storyline according to tourist guide

Come to our MWC 2019 booth for a Extended Connected Home scenario!

Showcased Benefits

- End-to-end delivery of LAN-based end-to-end network
  - WLAN instead of 5GLAN for now
- Multicast of HTTP content over Layer 2
  - Gain is linear to number of users!
- Multicast over radio link
  - Assumes broadcast capability on radio link!
- Reduction of E2E latency through fast re-routing of service requests to local server

Challenges Encountered

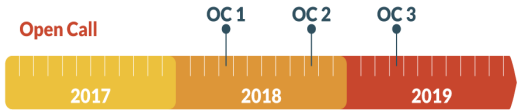
- Infrastructure integration
  - Openstack mainly the basis for infrastructure with many detailed configuration misalignments
    -> makes replication difficult but 3GPP based network slicing is meant to remedy that!
- Infrastructure readiness
  - Building a multi-tiered micro data centre infrastructure is hard
    -> investment needed but also the configuration/devOps work!
- Technology readiness
  - Building an orchestration-based service management platform is hard
    -> moving timelines
- Use case readiness
  - Many use case developers still think OTT, i.e., the distant cloud thinking prevails
    -> needs direct working with application developers to think distributed computing (again)

Conclusions

- FLAME is a ground-breaking 5G project exploring the acceptance, viability and performance of 5G technologies for media
  - flexible service routing, mobile edge computing and cross layer management and control

- FLAME platform is ready and deployed at city-scale real-life infrastructures
  - driving adoption through urban scale trials and experimentation
  - multi-stakeholder experimentation across the full stack

- FLAME's open call investment strategy (2.2M Euros) offers opportunities to get involved
  - Nov-18: replication projects for new infrastructure providers
  - Nov-18, Apr-19: trial/experimentation projects for media service and application providers



FLAME Online

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THANKS FOR YOUR ATTENTION!

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