FLAME

FACILITY FOR LARGE-SCALE ADAPTIVE MEDIA EXPERIMENTATION

Service design and development patterns for interactive edge computing experiences

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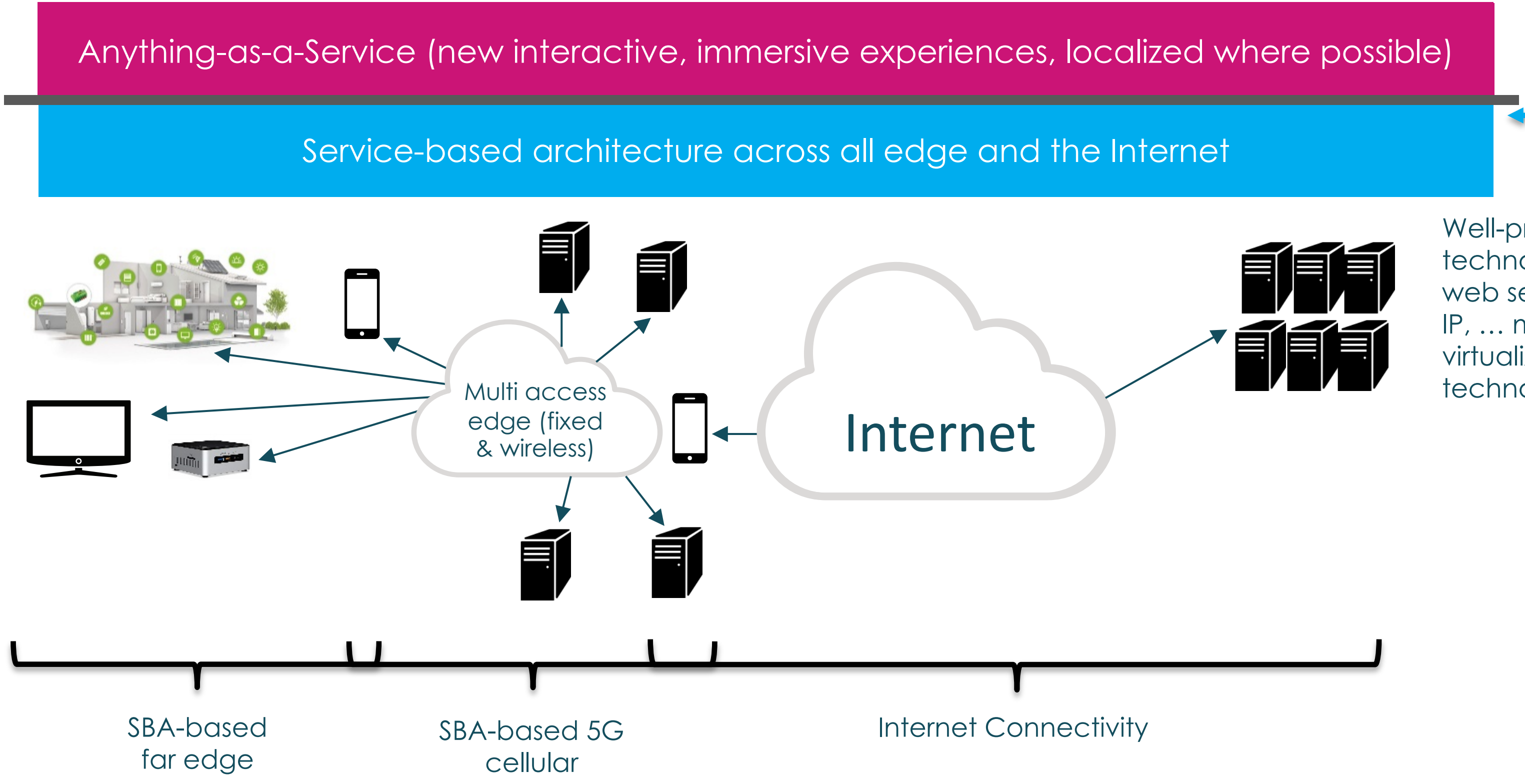
17/06/2019

Micro-Services From Far-Edge to Distant Cloud



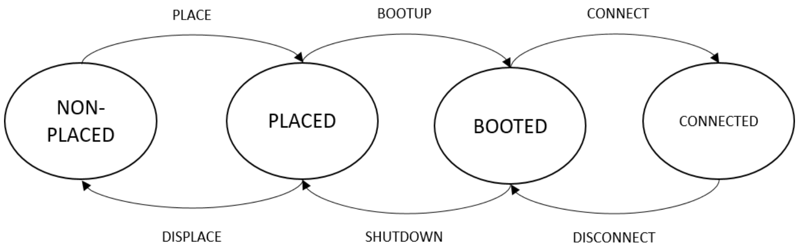
Well-proven Internet technology, such as web services, HTTP, IP, … mixed with virtualization technology

Micro Services Architecture

- Microservices architectures contain a collection of small self-contained services typically implementing a single function
  - deployed independently, persist their own data/state, communicate through well-defined APIs, and may not share technology stacks
  - benefits include agility, resilience, scalability, etc.
  - challenges include complexity, testing, decentralised governance, etc.
- Microservices are old news but FLAME offers some distinct lifecycle management and control features that create useful patterns

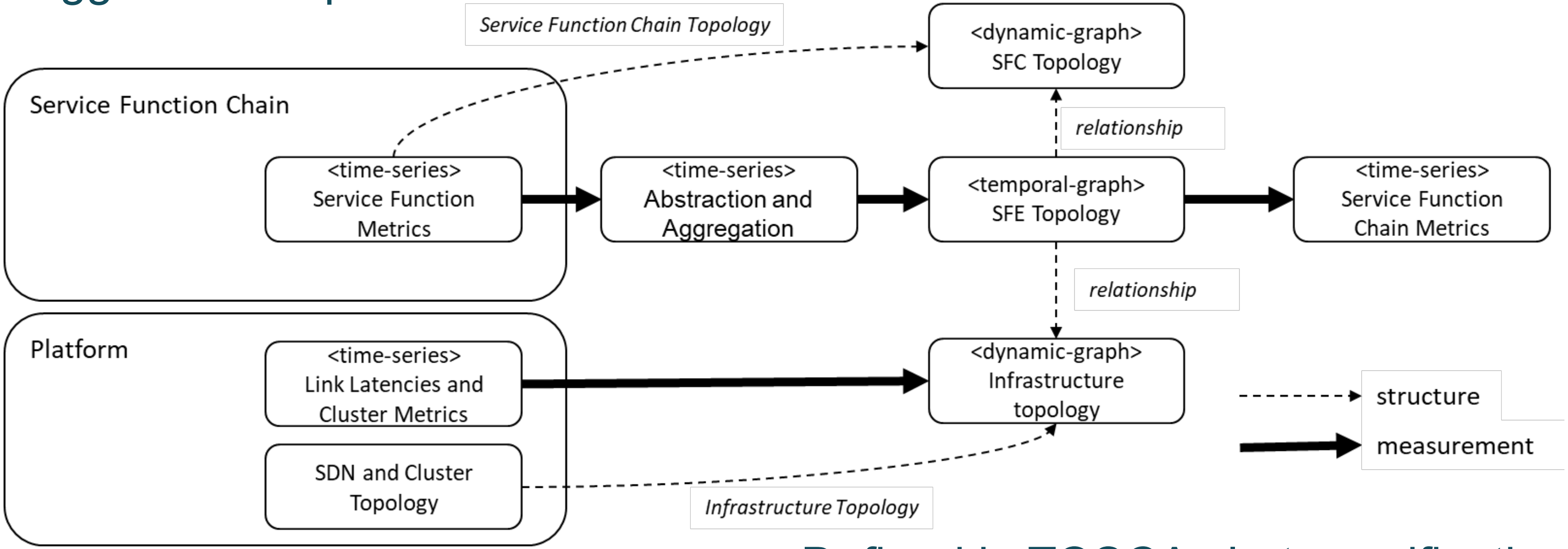
Management and Control Features

- FLAME uses policies to control the lifecycle state of service function endpoints
  - Placed – Image deployed on cluster
  - Booted – SFE booted on cluster
  - Connected – SFE connected to network
- Defined in TOSCA resource specification



Monitoring and Alerting Features

FLAME uses time-series/ cross-layer graph monitoring and alerts to trigger control policies



Defined in TOSCA alert specification

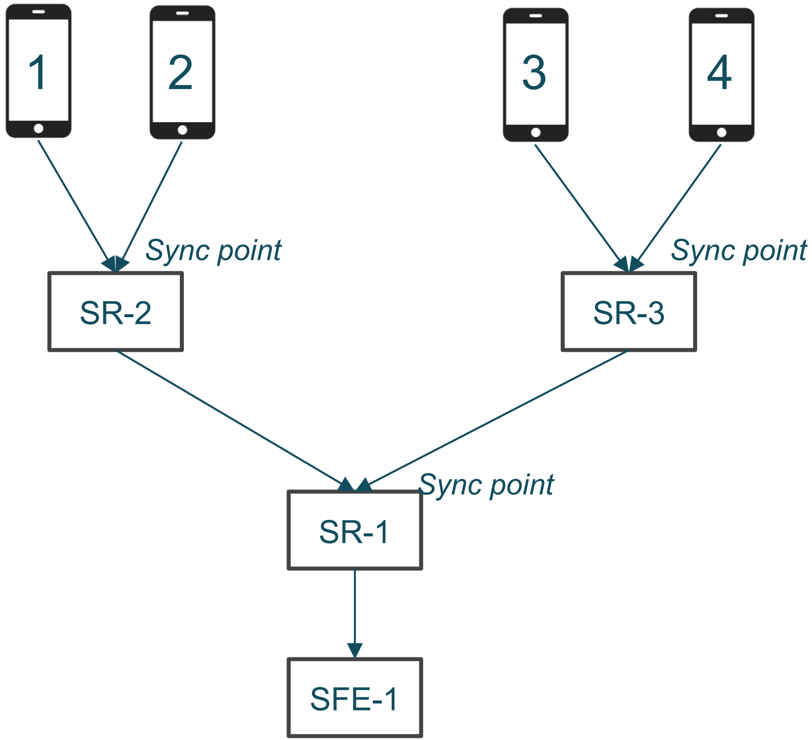
Types of Scaling

- Scale Up (not FLAME)
  - moving to a larger instance or upgrading resources, typically traditional applications
  - E.g. increasing a server resource using OpenStack
- Scale Out (FLAME)
  - adding more instances to a service, system or application
  - E.g. internal load balancer such as Docker Swarm or Kubernetes
- Scale Geographically (FLAME)
  - Scaling a service to run in different geographical locations including mobile edge and other data centres
  - E.g. Triggers control states of SFEs (PLACED, BOOTED, CONNECTED) in specific compute nodes

FLAME Service Patterns

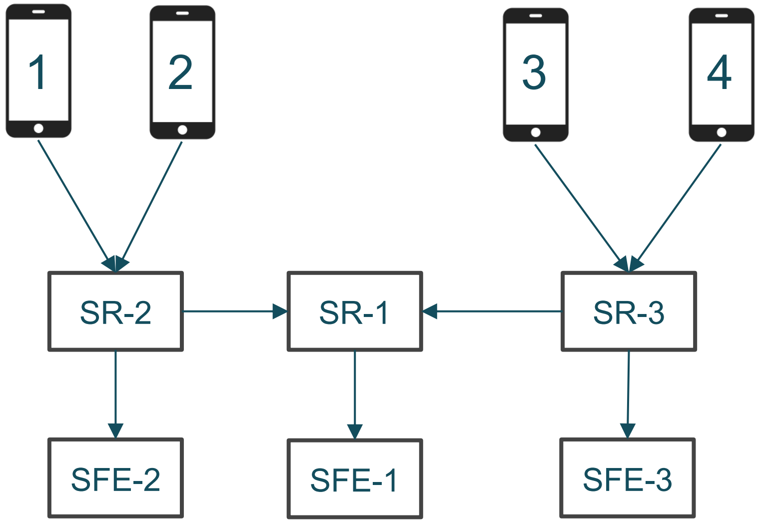
Sync'd Playout

- High bandwidth video streaming (4K VR) to many clients from one playout point
- Provider value
  - Cost reduction (reduced AWS network usage) as video is front loaded to the edge
  - Cost reduction of server usage (http request suppression when multicast occurs)
- Experience value
  - Reduction in startup time for playout (avoids download)



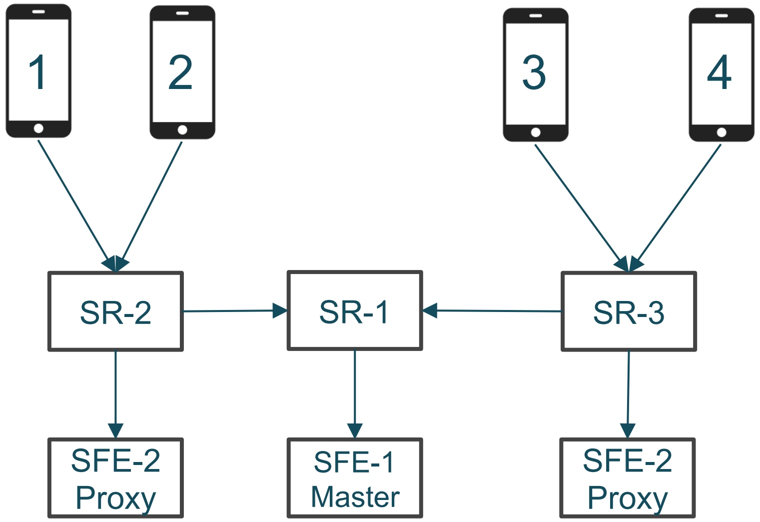
Nearest Playout

- Serve request from the closest service function
- Provider value
  - Cost reduction in network usage
  - Cost reduction since no replication required
- Experience value
  - Reduction in startup time for playout
  - Reaction time to latency changes
  - Content can be uploaded/placed anywhere and access anywhere
- Assumption the closest gives the best performance



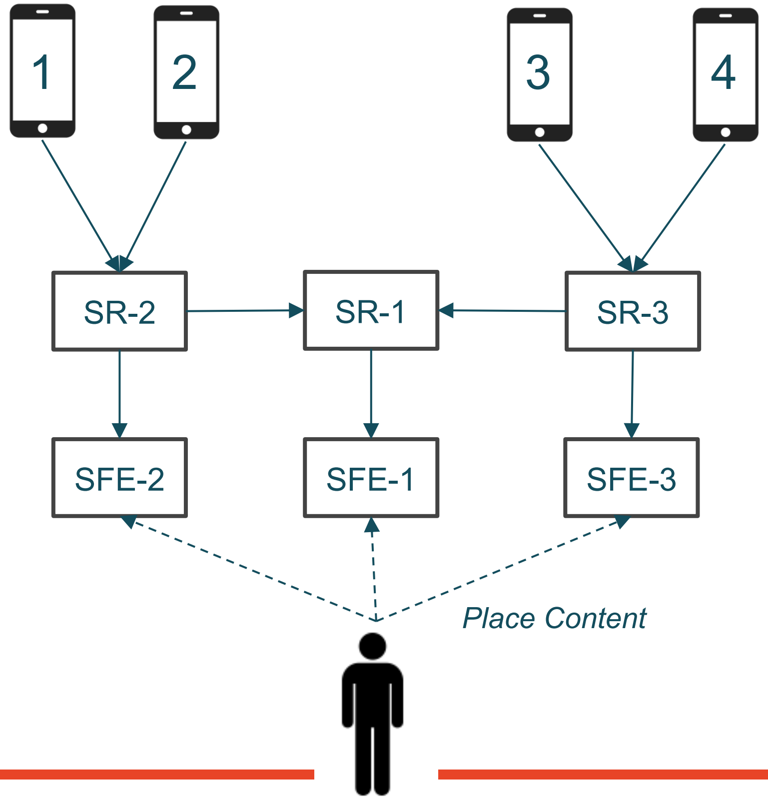
Proxy Cache Playout

- Serve request from the closest service function proxy cache
- Provider value
  - Cost reduction in network usage
  - No preloading required
- Experience value
  - Reduction in startup time for playout
  - Reaction time to latency changes



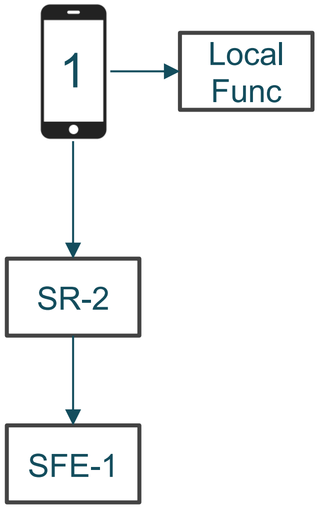
Content Placement

- Place content within specific service function endpoint at a location within the network
- Provider value
  - Cost reduction in network usage
  - Preload for expected demand
- Experience value
  - Reduction in startup time for playout
  - Reaction time to latency changes



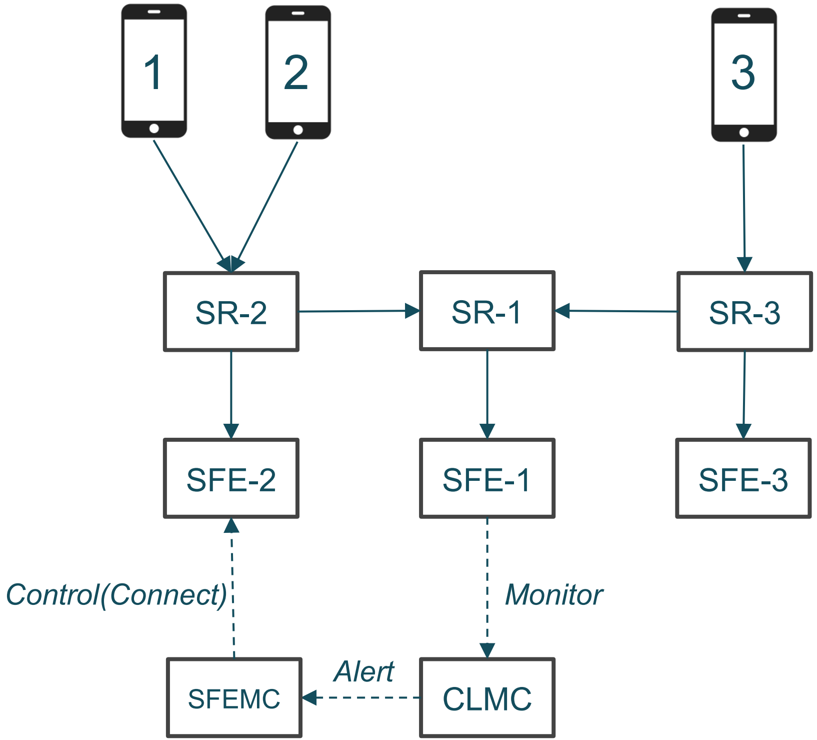
Application Function Offloading

- Offload local terminal-centric functions to network elements
- Provider value
  - Terminal improvements (e.g., battery)
- Experience value
  - Utilize better device capabilities (e.g., better displays)



Scale Geographically

- Place content within specific service function endpoint at a location within the network
- Provider value
  - Cost reduction in network usage
  - Preload for expected demand
- Experience value
  - Reduction in startup time for playout
  - Reaction time to latency changes



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This project received funding from the European Union's Horizonhas 2020 research and innovation programme under grant agreement No 731677

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