Service design and development patterns for interactive edge computing experiences

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Urban Hacking in 5G

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Micro-Services From Far-Edge to Distant Cloud

Anything-as-a-Service (new interactive, immersive experiences, localized where possible)

Service-based architecture across all edge and the Internet

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

Multi access edge (fixed & wireless)

SBA-based far edge
SBA-based 5G cellular
Internet Connectivity

Internet
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
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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