Power Aware Media Delivery Platform Based on Containers

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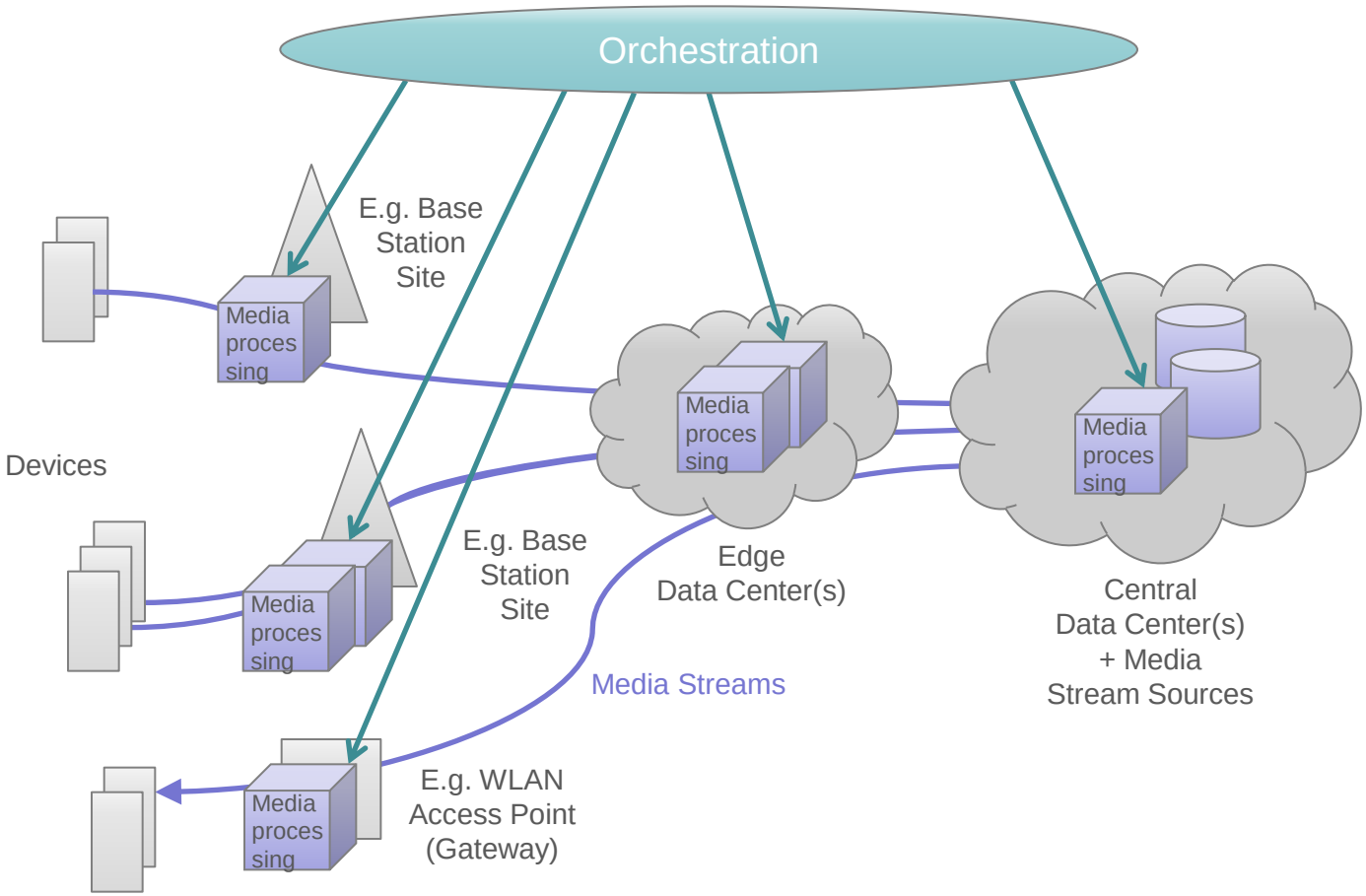
Energy-efficient Media Streaming to Mobile Terminals

- Basic use case: Streaming of videos over the Internet to mobile terminals

- Background: Power savings in mobile terminals can be achieved by optimizing media streams in the network
  - Examples:
    - Traffic shaping: buffer streams near terminals (e.g., in Wi-Fi access points) and allow devices to sleep – up to 65% savings
    - Content adaptation: (e.g.) transcode a stream for terminals that want to save energy

- Goal: Make it possible to deploy such functions automatically and dynamically into nodes in the network with a generic mechanism

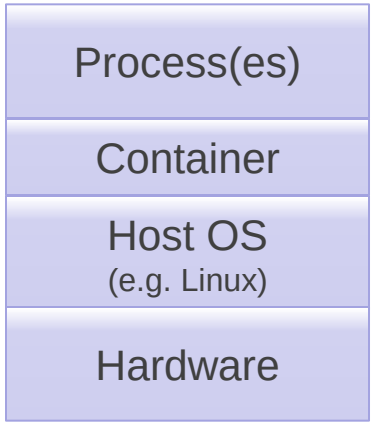
Distributed, Ubiquitous Cloud



Containers

- Packaging
  - Image: file system with application(s) and dependencies
  - Distribution from (e.g.) image repositories

- Execution
  - "Lightweight virtualization": process isolation, resource limits, etc.
    - Based on, e.g., Linux namespaces + control groups + security modules + overlay file systems



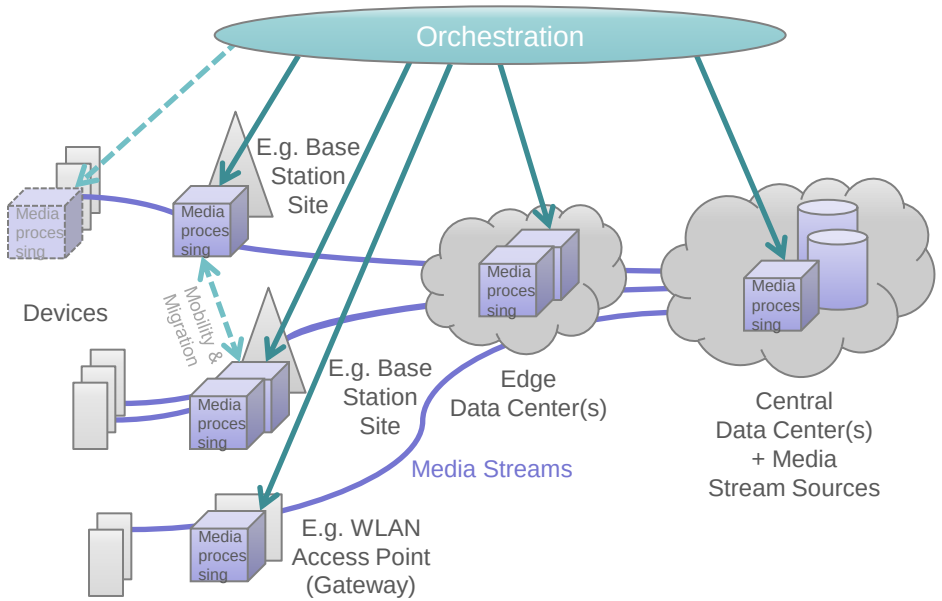
Containers

- Benefits, e.g.:
  - Standard, generic deployment mechanism
    - Has become a very popular technology
  - Fast and flexible service deployment
    - Fast startup times: ~1 s or even less, can be deployed on demand
  - Low overhead
    - Memory footprint, performance, power consumption, …
    - Higher density of instances in cloud nodes, lower system requirements
  - Can run also in constrained nodes
    - E.g., they do not require hardware-assisted virtualization (unlike VMs)
    - The same mechanism can be used across a heterogeneous cloud

- Drawbacks, e.g.:
  - Containers depend on the underlying host operating system (kernel, etc.)
  - Security concerns (especially in multi-tenant nodes)
  - Typically run quite high-level services (restricted access to host interfaces, etc.)

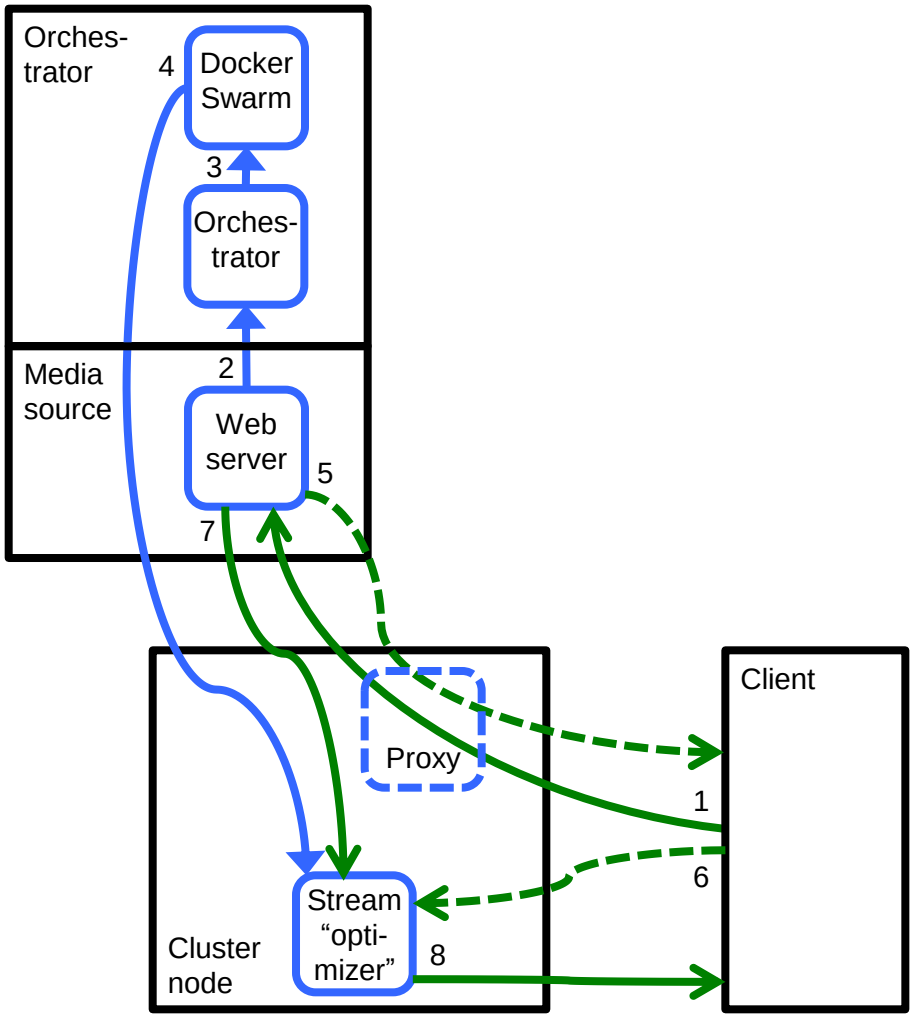
Orchestration of Media Functions

- Dynamic scheduling/placement of media stream processing functions into suitable nodes in the cloud
  - Achieve power savings in terminals and overall
  - Consider available resources and other constraints, location and type of media consumers and groups, mobility, media stream characteristics, …



  - Examples:
    - Deploy a traffic shaping function in a Wi-Fi AP, close to a device (in order to avoid re-shaping of the traffic on the way)
    - Deploy a transcoding function further upstream in order to potentially save energy also in the network

Implementation (work-in-progress)



Summary

- We’re proposing a container-based platform for deploying media processing functions into a distributed, ubiquitous cloud
- The purpose is to optimize media streams in order to save energy in mobile terminals

- Future work, e.g.:
  - Development and/or application of placement algorithms (etc.) suitable for this context
    - Many design and implementation details to be worked out
  - Evaluation of relevant use cases

Thank you!

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