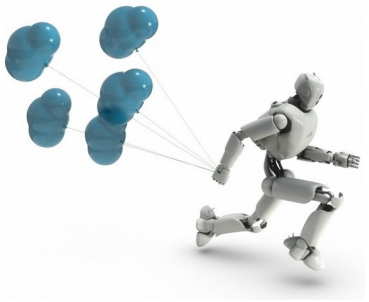

Fast Cloud
Mobile edge clouds for 5G networks

Technische Universität Dresden

ComNets
Deutsche Telekom Chair of Communication Networks

HAEC
Highly Adaptive Energy Efficient Computing

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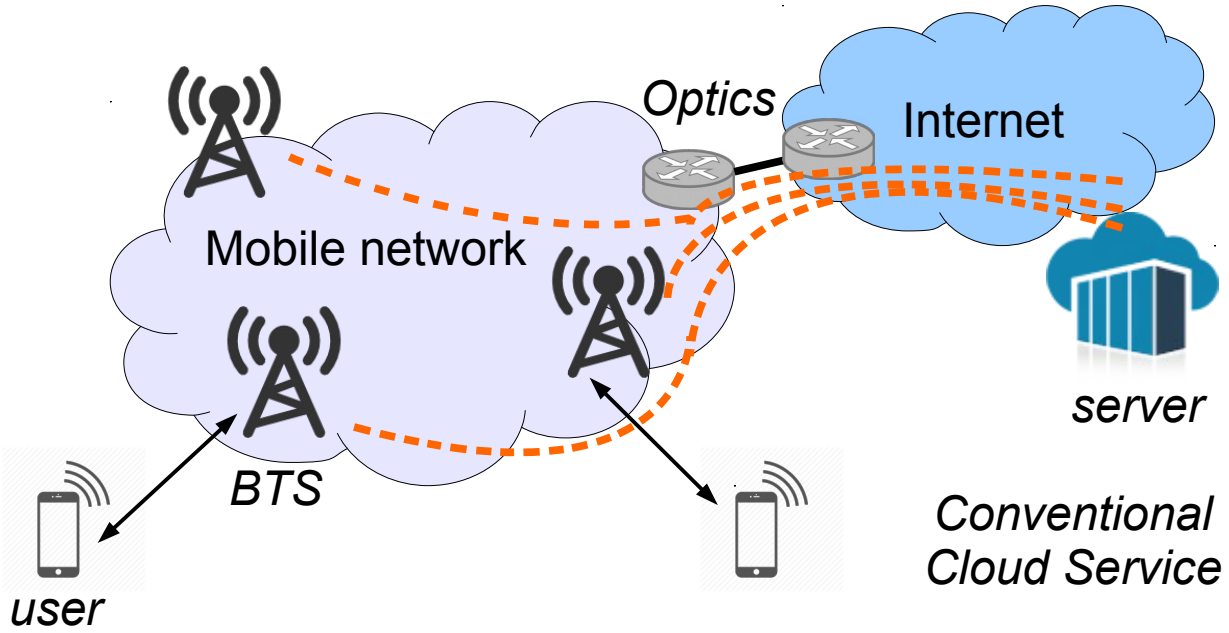
10.06.2016

Motivation

- Cloud services: more and more popular nowadays
- Cons of single cloud:
  - Long latency
  - Single PoF
- Multiple clouds:
  - More availability
  - Vendor lock-in
  - Delay variance
- 5G scenarios:
  - 500B devices
  - Massive latency requirement (1ms)



How to reduce the latency of cloud services for 5G networks?

Agenda

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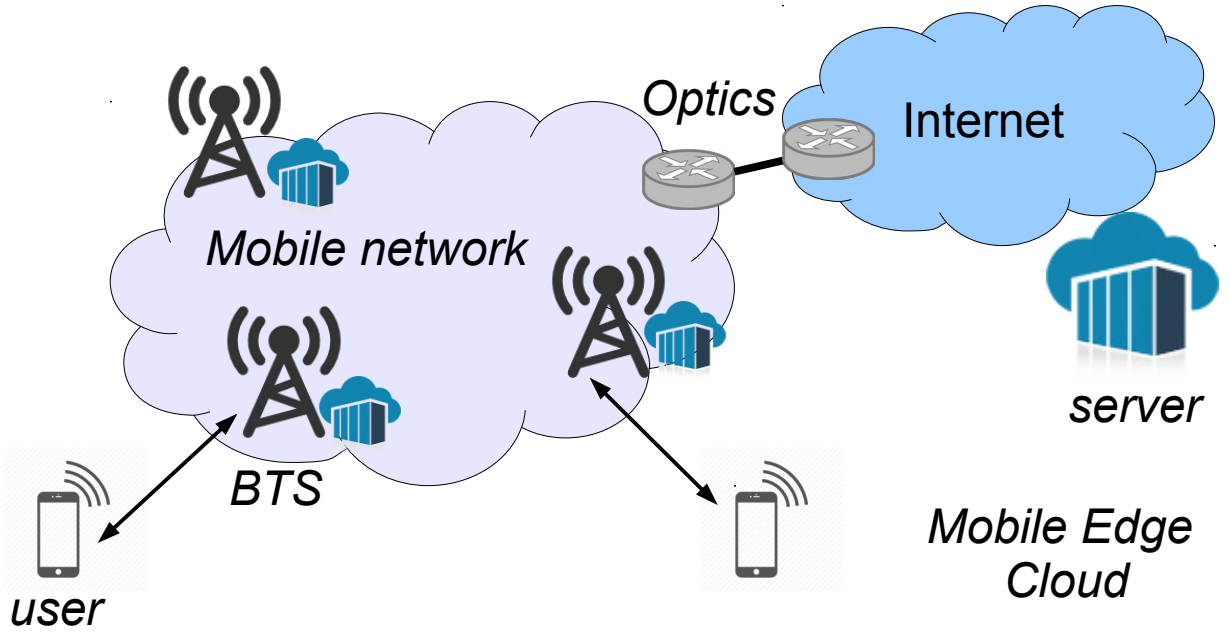
1. Introduction
2. Research questions
3. Micro data center
4. Evaluation methodology
5. Summary

Introduction

- Mobile Edge Cloud:
  - Clouds close to users
  - Orchestration
- Expected features:
  - Agile
  - Distributed
- Advantages:
  - More security
  - More availability
  - Extremely low latency for control or steering



Research questions

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1) How to provision and orchestrate cloud services?

2) How to migrate cloud service for moving users?

3) Which micro data center at the edge?

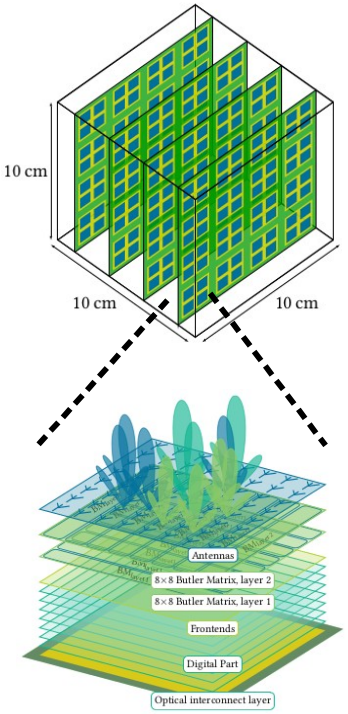
4) How can we evaluate our solutions?

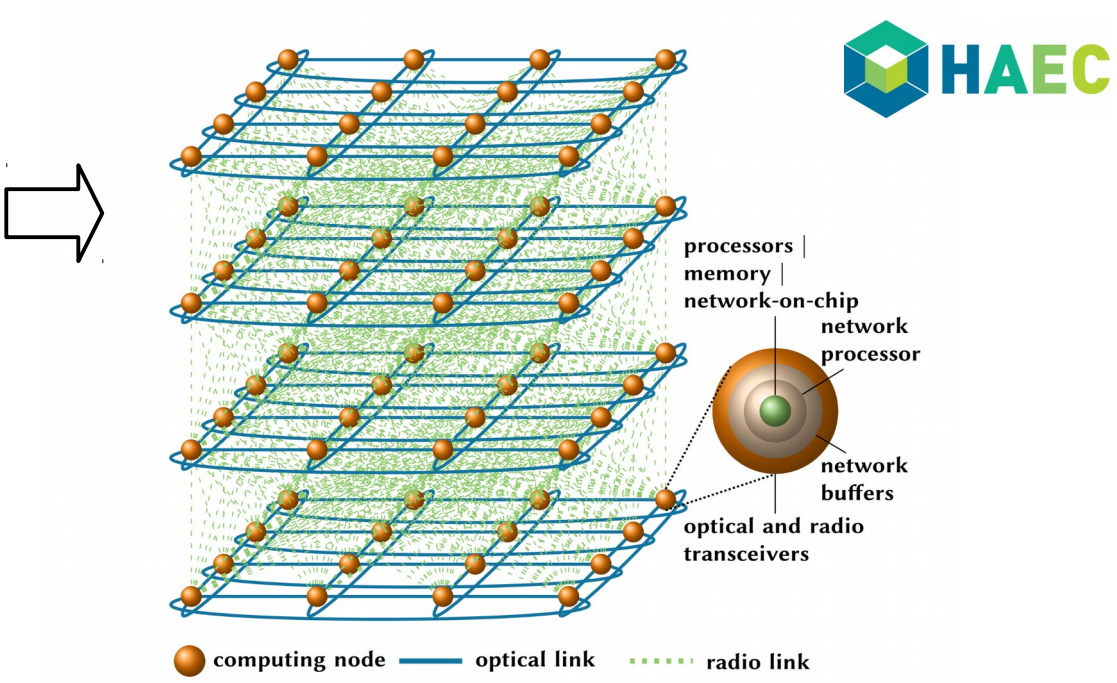
Micro data center (HAEC box)

- Electricity consumption of ICT: on the rise
  - 4.6% worldwide (in 2012)
  - Annual growth rates of 7%
- HAEC: Highly Adaptive Energy-efficient Computing

HAEC box:
- 1 liter
- 100M cores

Chip stacks:
- 50k cores
- Antenna array





Model of the HAEC box

HAEC Playground

Hardware:
- Chip stack
- Optics
- Radio

Architecture:
- Phy. layer security
- Adaptive routing
- Edge caching

Software:
- Energy-adaptivity
- Exploits versatility

HAEC Playground
as a melting pot

Evaluation methodology (1)

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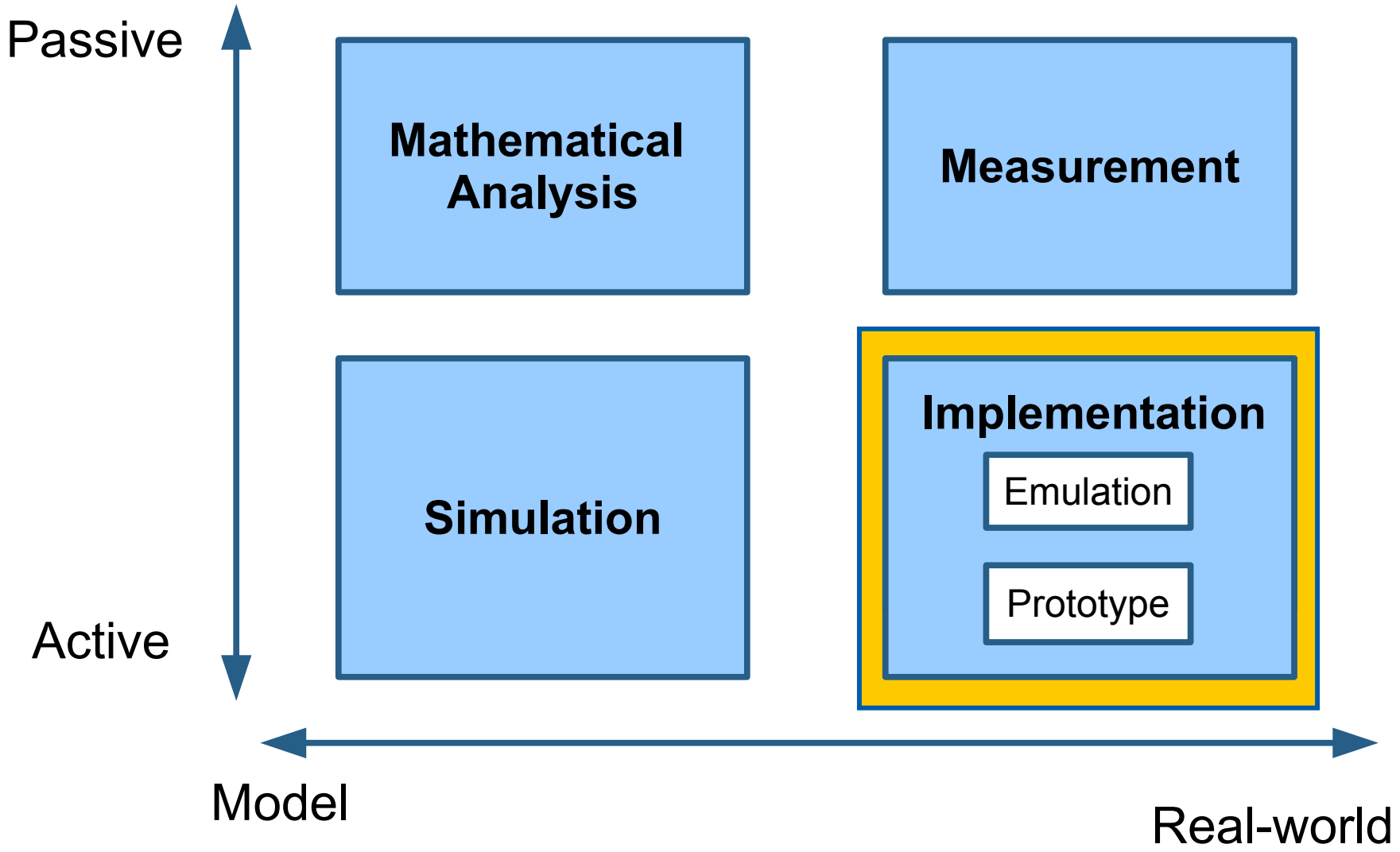
- Network simulation: widely used
- Advantages
  - Cost effective
  - Suitable for what-if situations
  - Applied at many different levels of abstraction
- Drawbacks
  - Simplified models
  - Unrealistic assumption on system's behaviors

What are the alternatives?

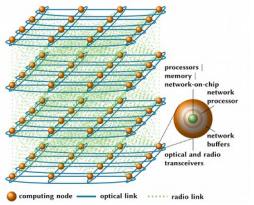
Evaluation methodology (2)



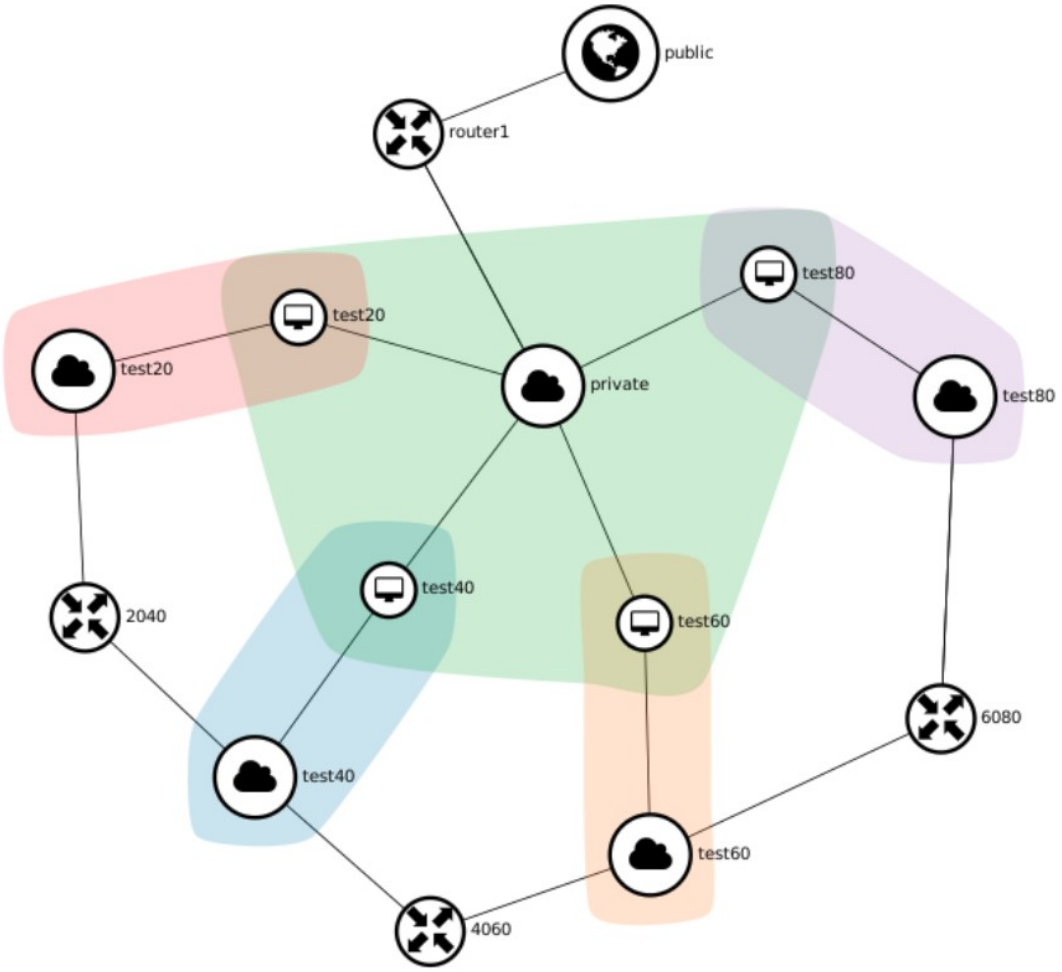
Evaluation methodology (3)

openstack™ CLOUD SOFTWARE

- OCCI
- Avoid vendor lock-in
- Open source



For HAEC, and more...



Topology generated and orchestrated in OpenStack

Summary

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1) For cloud service to meet demands of 5G:
To reduce latency

2) Fast cloud: to place clouds closer to end users

3) Many challenges
   - Provision of cloud service deployment
   - Migration of cloud service for mobile users

4) Selective on-going activities
   - Micro data centers (HAEC Box)
   - Emulation/testbed with OpenStack