Mobile & Cloud Computing Seminar

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https://mc.cs.ut.ee/
Aim of the seminar

- Discuss research in the Mobile, Cloud and IoT fields
- Introduce students to newest advances in these fields
- Provide an overview of thesis topics from Mobile & Cloud Lab
- Preliminary platform for investigating prospective thesis topics
- Help students in preparing proper technical reports
- Help students in making proper presentations
Passing the seminar

• Choose a seminar topic
  – Introduce the topic to others

• Give a presentation on the topic
  – Teaching other students the essence of the topic and its challenges

• Write a report on the chosen topic
  – 5 pages ACM double column format

• Peer review the work of other students

• Participate actively in all the seminars

• Update seminar topic supervisor consistently
Course schedule

• Thursdays at 12:15 – 13:45
  – Room: Delta – 2047
  – May turn into online seminar

• Schedule of the sessions
  https://courses.cs.ut.ee/2020/mcsem/fall
  – Also submit presentations, report, reviews through this web site
Cloud Computing

• Computing as a utility
  – Utility services e.g. water, electricity, gas etc
  – Consumers pay based on their usage

• Cloud Computing characteristics
  – Illusion of infinite resources
  – No up-front cost, Fine-grained billing

**Gartner:** “Cloud computing is a style of computing where massively scalable IT-related capabilities are provided ‘as a service’ across the Internet to multiple external customers”
Cloud Computing directions

• Dynamic deployment of applications across multiple clouds using CloudML
  – REuse and Migration of legacy applications to Interoperable Cloud Services (REMICS) FP7 EU
• Auto-scaling & Resource provisioning
  – Cloud cost models for optimizing the cost of up & down scaling
• Resource management and scheduling in cloud
  – Static VM provisioning policies (e.g. allocate resources to VM/containers using bin-packing)
  – Dynamic policies (live VM/container migrations) & Smart scheduling
• Serverless computing
• Information centric networking (ICN)
• Software defined networking (SDN)
EU H2020 -RADON

- **Rational decomposition and orchestration for serverless computing** (RADON)
  - H2020 EU Project
  - Jan 2019 to Jun 2021
  - 3 PostDocs, 3 Msc students working on the project
- Creating a DevOps framework for managing FaaS and data pipeline applications
- OASIS - Topology and Orchestration Specification for Cloud Applications specification (TOSCA)
- Case studies
  1. Assited living smart home system
  2. Tourism application – Data fusion from location based services
  3. FaaS built function Hub for FaaS
Internet of Things (IoT)

The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service.

[Kip Compton]
[Perera et al, TETT 2014]
Internet of Things – Challenges

How to provide energy efficient services?

How do we communicate automatically?

How to interact with ‘things’ directly?

Sensors

Tags

Mobile Things

Appliances & Facilities

[Chang et al, ICWS 2015]

[Chang et al, SCC 2015; Liyanage et al, MS 2015]
Cloud-based IoT

Remote Cloud-based processing

Connectivity nodes & Embedded processing

Sensing and smart devices

[Srirama, CSIICT 2017]
Issues with Cloud-centric IoT

• Latency issues for apps with sub-second response requirements
• Certain scenarios do not allow moving data to cloud

• Edge Computing
  – Processing data near the source

• Mist computing
  – Co-operative processing among the edge devices

• Fog computing
  – Processing across all the layers, including network switches/routers

• Edge/Fog process management and scheduling
• Serverless Edge Computing

What can be improved?
IoT Big Data analytics on cloud

• QoS guarantees of streaming data
  – Dynamic allocation and reallocation of resources

• Data pipelines
  – Orchestration of end-to-end data pipelines from data source to cloud
  – AWS Data pipeline, Apache NiFi

• Edge analytics

• Serverless Big Data Processing
  – Mist - Serverless proxy to Apache Spark
  – Distributed Data processing across Fog & IoT networks
Research Roadmap

Distributed data processing on the Cloud
E.g. MapReduce, Spark

Distributed data processing across the Cloud and Fog layers
E.g. Personalized data, privacy etc.

Fog topology management and scheduling the tasks
E.g. tasks run across the fog topology such as stream data processing, smart streetlights etc.

Edge analytics
E.g. filter, error detection, consolidation etc.

Intelligent sensors
E.g. vehicular networks
Mobile Computing

- Mobile Cloud Computing
- Today's mobiles have high performance
  - But issues with energy efficiency & battery life
- Invocation of web services from smart phone
- Mobiles as sensor platforms or Edge devices
- Mobile positioning (Indoor and Outdoor)
Seminar topics

• Topics are available at
  – https://courses.cs.ut.ee/2020/mcsem/fall/Main/Topics

• Session 2 (10 September)
  – Finalizing the seminar topic choices
  – Email jakovits@ut.ee and topic supervisor by 11 Sept

• Session 3 (17 September)
  – Presentation by students about their topics
  – 5 min per person
  – Backed by slides
TOPIC SUPERVISORS
Pelle Jakovits

- Lecturer of Distributed Computing
- Real-time distributed data processing
- Big Data
- Cloud Computing frameworks
- IoT frameworks
- FaaS at the Edge
Chinmaya Dehury

• PostDoc
• RADON
• Topics:
  – Machine learning models for Cloud resource management
  – Predicting Cloud service demands
  – IoT and Fog computing
  – Efficient task scheduling
Mainak Adhikari

- PostDoc
- RADON
- Topics:
  - Federation Learning (FL) at edge
  - Cross-Domain Interoperability
  - Efficient Task Scheduling in Cloud and Fog
Jakob Mass

- PhD student
- Adaptive Integration of Abundant Cyber Physical Systems for Reliable Internet of Things
- Topics:
  - Internet of Things
  - IoT Frameworks, Wireless protocols
  - BPMN models for managing IoT data and processes
  - Mobile computing
Shivananda Poojara

• PhD Student
• Design and orchestration of Scalable, Event-driven Data Pipelines
• Topics:
  – Serverless computing at the Edge
  – Container/VM migration
  – Data Pipelines
  – Edge Analytics
Satish Sriama

Founder and Honorary head of the group
Related Courses

- LTAT.06.009 - Mobile Computing and Internet of Things (6 ECTS) - Current Autumn semester
- LTAT.06.008 - Cloud Computing (6 ECTS) – Spring 2021
THANK YOU