Advanced Services Engineering- Introduction

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Outline

- Why do we need a course on advanced services engineering?

- What is the course about?

- Course administrative information

Current trends: emerging systems

- **Internet of Things (IoT)/Cyber-physical systems**
    - Integration and virtualization of sensors/actuators and edge networks

- **IoT and cloud integration → IoT cloud systems**
    - Dealing with sensors/actuators and gateways integration with cloud data centers

- **Fog/edge computing and mobile-edge computing**
    - Nano/micro data centers + cloud-based data centers
    - Incorporation of Network Function Virtualization (NFV)/5G

- **Blockchain protocols and systems**
    - decentralized distributed ledger

Current trends: data, software, and services

- **„Big" and „small" data**
    - Data from Things (Internet of Things)
    - Human-sensing data, science data
- **Big data analytics**
    - Streaming processing and Machine Learning as a Service
- **Human-Machine interaction**
    - Individuals, crowds and collectives augmenting machine intelligence
    - Intelligence Amplification
- **Elastic Services**
    - Dynamic, flexible data, computation and analytics provisioning and integration models

ASE – complex requirements

- **Data -** big and near real-time data must be handled in a timely manner to extract insightful information

- **Systems -** complex applications/systems executed atop multiple, diverse distributed computing environments
    - Data centers/cloud infrastructures, IoT systems, human computation environments, blockchain, etc.

- **Quality -** cross-boundary, multiple concerns w.r.t trustworthiness, quality, regulation and cost/benefits must be assured.

- **Intelligence -** machine learning techniques & human knowledge

- **Elasticity -** flexible and dynamic management
    - Multi-dimensional elastic capabilities

For complex functions offered across distributed cloud and edge computing environments

- We want to have a coherent, uniform view of diverse types of resources and platforms
- We want to coordinate capabilities of these resources and platforms
- Intelligence,

→ Engineering systems for such requirements is very challenging

EXAMPLES FROM PREVIOUS YEARS

http://www.infosys.tuwien.ac.at/teaching/courses/ase/#examples

Questions

ARE YOU WORKING ON SUCH SYSTEMS? IS THIS COURSE SUITABLE FOR YOU?

ASE – complex, diverse and elastic properties

- Different platforms and multiple types of data and services from multiple providers for multiple stakeholders

- Complex service-based systems
    - Not just big data in a single organization which can be dealt by using, e.g., MapReduce/Hadoop
    - Not just take the data and do the computation: how to guarantee multitude of data/service concerns?
    - Not just things and software: when do we need human services?
    - Not just local actions: we need coordination-aware techniques for multiple resources

→ **Quality expectation (from the users)** are elastic: they are not fixed and dependent on specific contexts!
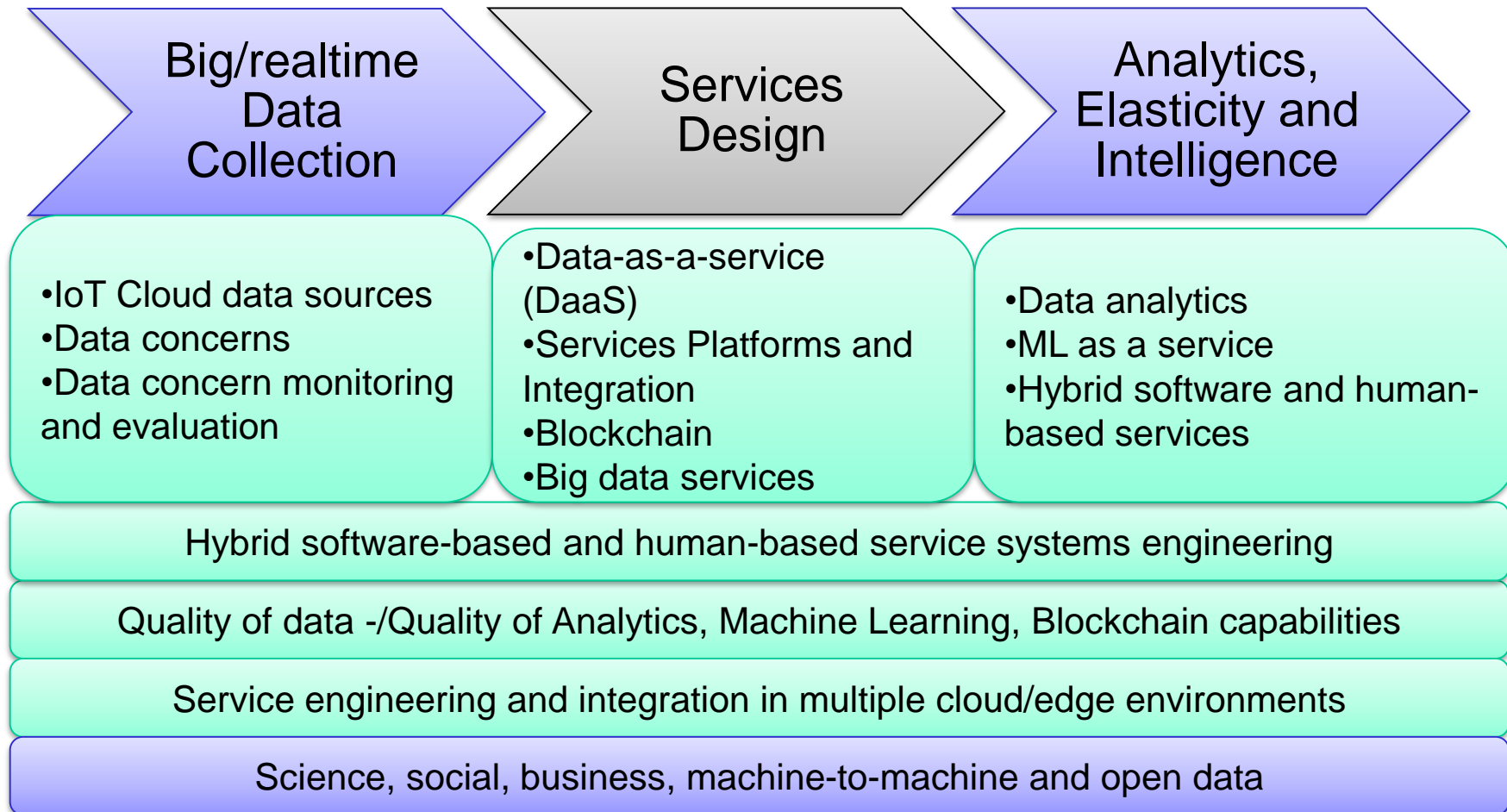
ASE – relevant courses

- **Existing courses provide foundations**
  - Advanced Internet Computing
    - Give you some advanced technologies about SOC, Cloud Computing and (business) processes/workflows
  - (Advanced) Service-oriented and Cloud Computing
    - Give you fundamental distributed system concepts and technologies
  - Distributed Systems Technologies:
    - Give you fundamental distributed technologies and how to use them
  - Recent TU Wien IoTcourses (introduced in WS 2017)
- **But they do not deal with engineering such large-scale, complex service-based systems**

What is the course about? (1)

- Discuss new concepts and techniques for engineering advanced service-based systems

- Focus on service systems that can combine features from *IoT, cloud, big data, human-machine interaction and blockchain* for elastic services

- Consider a wide range of applications for real-world problems in machine-to-machine (M2M), science and engineering, and social media

- Project-oriented course: you need to develop your own project!

We research and explore emerging techniques for interesting scenarios by utilizing existing, advanced technologies!

What is the course about? (2)

Big/realtime Data Collection	Services Design	Analytics, Elasticity and Intelligence
•IoT Cloud data sources •Data concerns •Data concern monitoring and evaluation	•Data-as-a-service (DaaS) •Services Platforms and Integration •Blockchain •Big data services	•Data analytics •ML as a service •Hybrid software and human-based services

Hybrid software-based and human-based service systems engineering

Quality of data -/Quality of Analytics, Machine Learning, Blockchain capabilities

Service engineering and integration in multiple cloud/edge environments

Science, social, business, machine-to-machine and open data

References for the course

- No text book designed for this course
    - Some references from recent scientific papers
- Relevant research in big data
    - But not very much on data management or individual data processing frameworks
- Relevant work in IoT, humans and software integration
- Distributed and Cloud computing, Edge computing
- Blockchain as a feature for services and services for blockchain-based applications

Course administration (1)

- Lectures are held through the whole semester
  - But not every week – check the course website!
  - Also backup dates
- Some tools from TU Wien
  - See sample of code from my team: https://github.com/rdsea/
  - Also old stuffs: http://tuwiendsg.github.io/iCOMOT/
- We have Google Cloud Education Grant for you!
  - But you should also be able to combine resources and services from various "free trials"
  - Amazon, Microsoft, MLab, CloudMQTT, Elastic.co

Course administration (2)

- Who could participate in the course?
  - Master students in advanced stages (e.g., seeking for master thesis) in informatics and business informatics
  - PhD students: normal PhD track, PhD School of Informatics, and Doctoral Colleges
  - Students should have knowledge about fundamental distributed systems, internet computing and distributed computing technologies
  - Bachelor students if you believe you can follow the workload !

If you are not sure, pls. unregister the course to give us more space and time (also if you decide to drop the course in the middle, pls. inform me!)

Course administration (3)

- Learning methods
  - Discussion, individual and team work, design, engineering and evaluation actions
- Evaluation methods
  - Assignments, a mini project and a final examination
- Assignments (hard deadline)
  - 4 home assignments resulting in some design/deployment and analysis summaries
- Mini project (hard deadline)
  - One mini project resulting in a small prototype/conceptual design
- Oral final exam (flexible, 30 minutes)

Assignments and Mini Project

- Define your interesting scenario
    - Look around, imagine and create your own scenario!
- Analyze and implement some concepts in the lectures
- Prototype and demonstrate your work
    - Code the prototype and present your work
    - We use github.com and we would like to make all code available (unless you have a reason to hide it)
    - Send your github account to me: https://github.com/AdvancedServicesEngineeringTUWien2018
- Results will be shown in the course website

Do not repeat existing topics for your 2018!
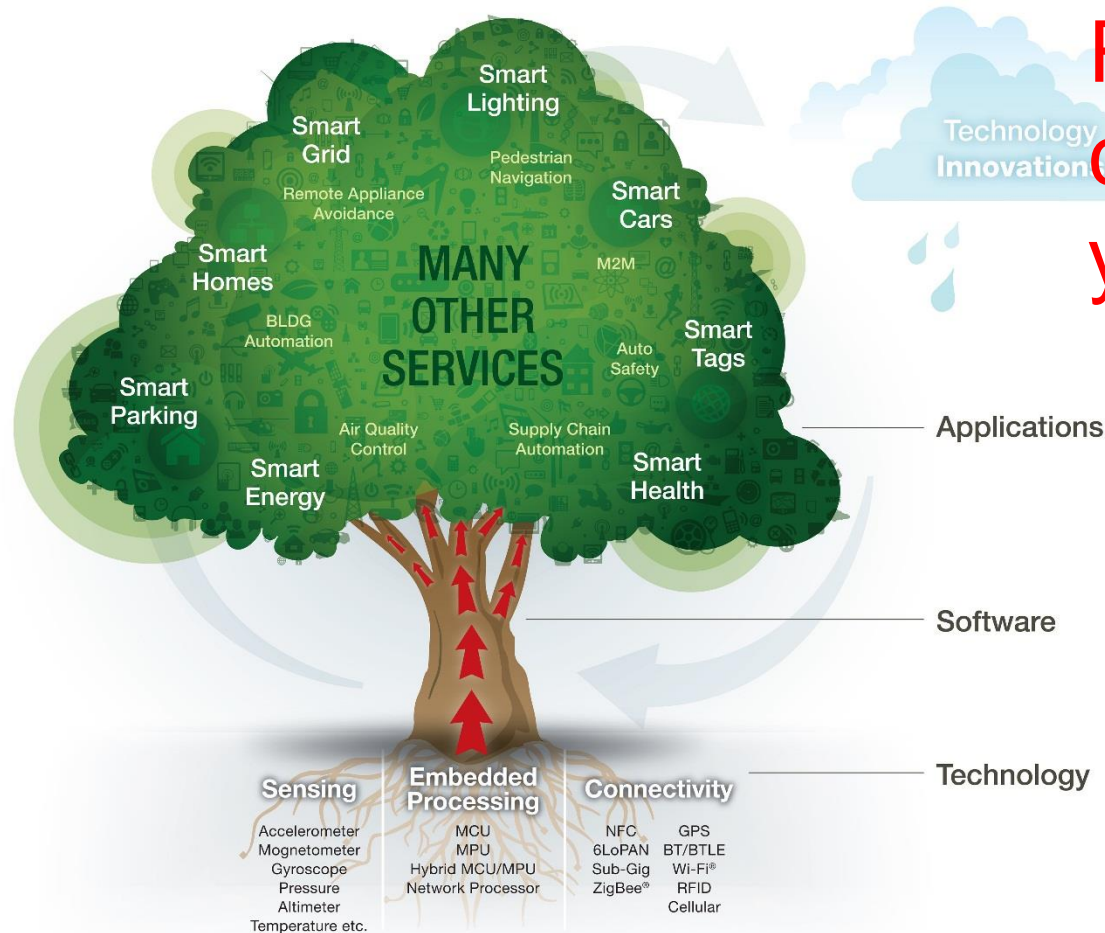
Remember I can also give you the topic!

Grades

- Participations + discussions: 10 points
- Assignments: 40 points
  - Two presentations: scenario and project proposal
- Mini project: 20 points
  - One demonstration (in a single section for all)
- Final oral examination: 30 points

Point	Final mark
90-100	1 (sehr gut)
75-89	2 (gut)
56-74	3 (befriedigend)
40-55	4 (genügend)
0-39	5 (nicht genügend)

Failed ? → retake the final oral examination part!

Thanks for your attention

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