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-centric and mobile-edge computing
  - nano/micro data centers + cloud-based data centers
- Social-cyber-physical clouds
  - Core elements: software, people and things
  - Systems: human computation platforms+ IoT platforms + cloud systems

Current trends: data, software, and services

- „Big“ and „small“ data
  - Data from Things (Internet of Things),
  - Human-sensing data, data marketplaces
- Software
  - High performance, scalable data analytics at data centers
  - Hybrid data analytics
  - Individuals, crowds, and collectives augmenting machine intelligence (cognitive computing)
- Services
  - Dynamic, flexible data, computation, and analytics provisioning and integration models
  - Human services for complex computation and analytics

ASE – complex requirements (1)

- Big and near real-time data must be handled in a timely manner to extract insightful information
- Cross-boundary, Internet-scale computation, data and network services integration must be done
- Complex applications/systems executed atop multiple, diverse distributed computing environments
  - Data centers/cloud infrastructures, IoT systems, human computation environments, etc.
- Multiple concerns w.r.t trustworthiness, quality, regulation and cost/benefits must be assured.
- Flexible and dynamic management, e.g., virtualization, and software-defined and elastic capabilities

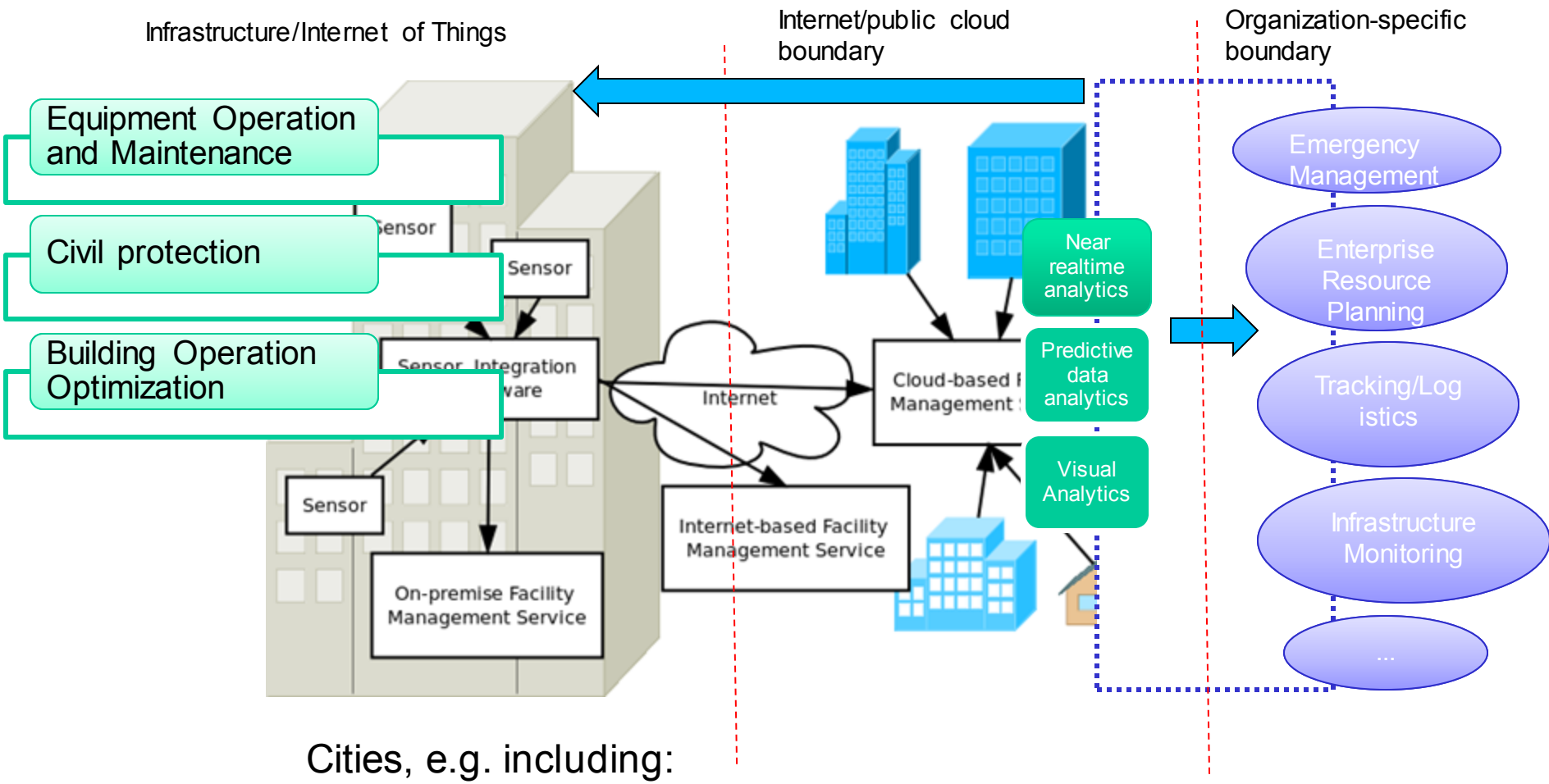
ASE – complex requirements (2)

For complex functions offered atop 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

→ Engineering service-based systems for these requirements is very challenging

ASE -- application examples (1)

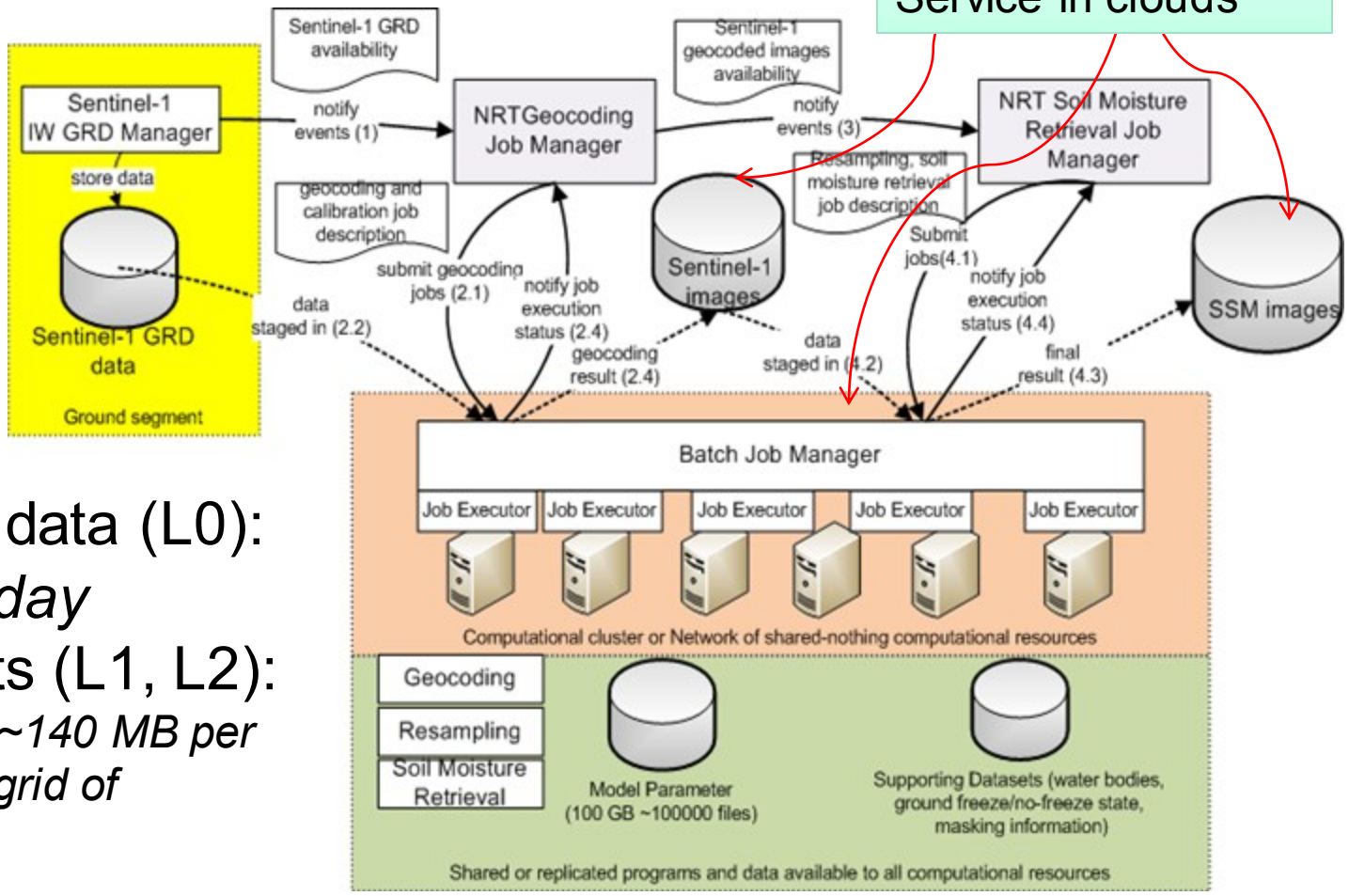


Cities, e.g. including:
10000+ buildings
1000000+ sensors

ASE – application examples - 2012 (2)

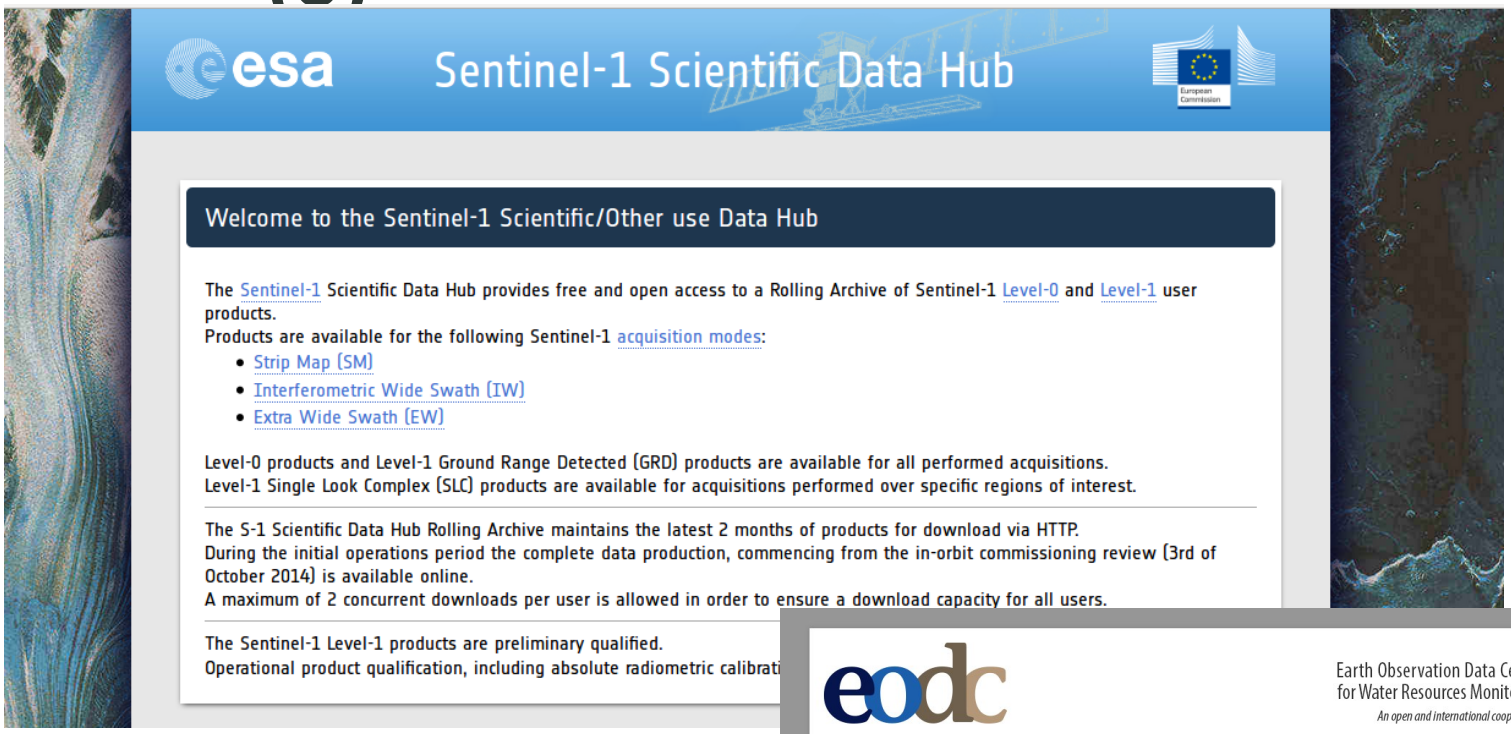
Data-as-a-Service and Platform-as-a-Service in clouds

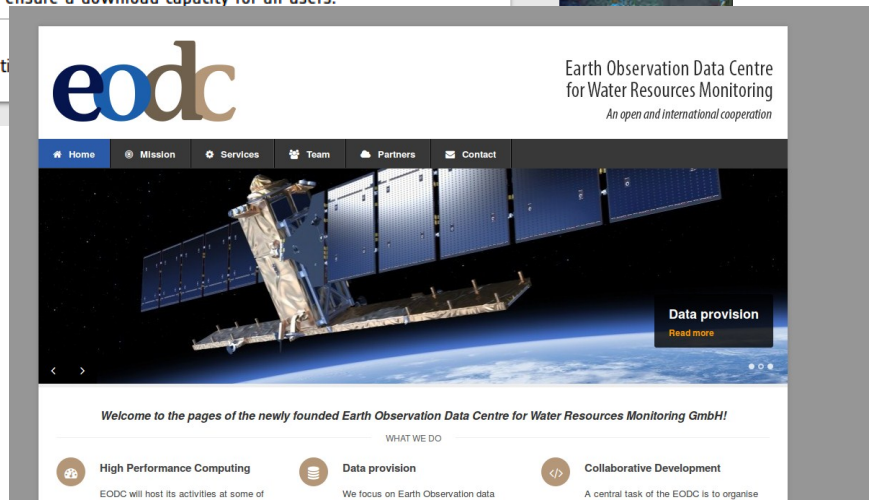
Soil moisture analysis for Sentinel-1



A lot of input data (L0):
~2.7 TB per day
A lot of results (L1, L2):
e.g., L1 has *~140 MB per day for a grid of 1kmx1km*

ASE – application examples - 2015 (3)





See: https://www.eodc.eu/

Mobile-edge computing

Source: Mobile-Edge Computing: Introductory Technical White Paper, ETSI. September 2014
https://portal.etsi.org/portals/0/tbpages/mec/docs/mobile-edge_computing_-_introductory_technical_white_paper_v1%2018-09-14.pdf

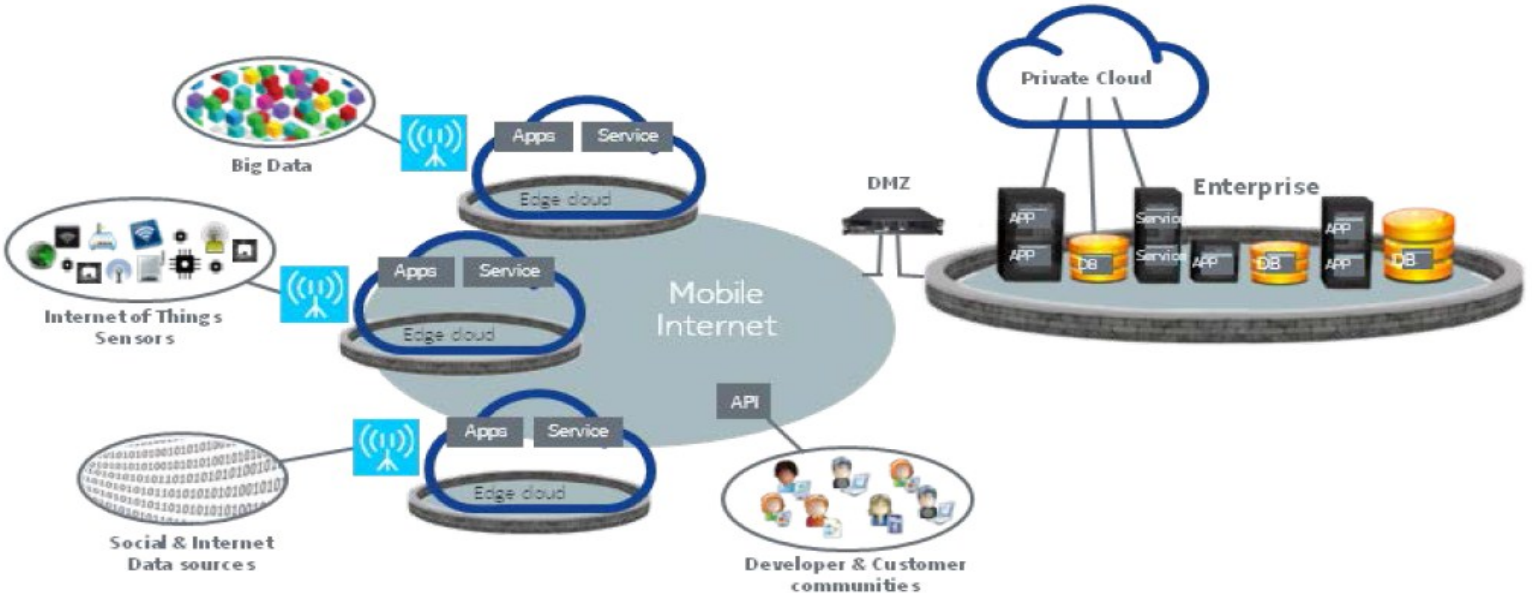
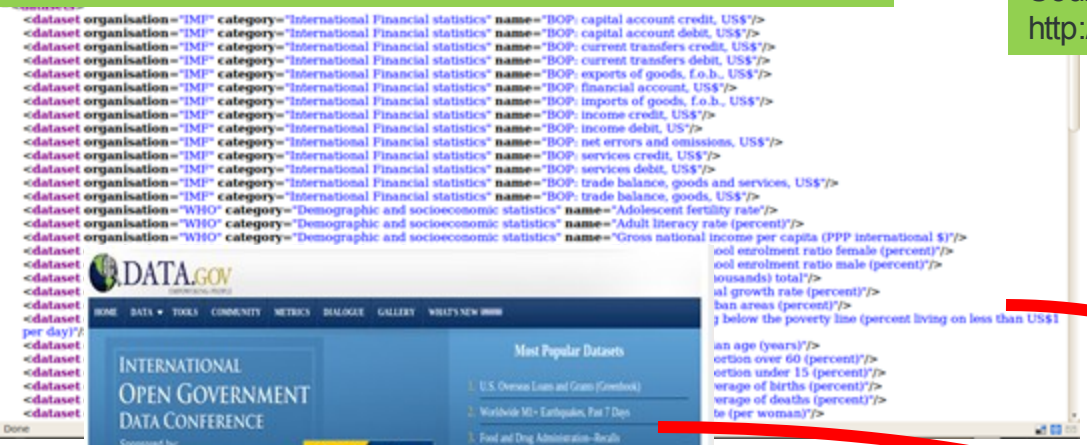


Figure 1: IT and Telecommunications networking convergence

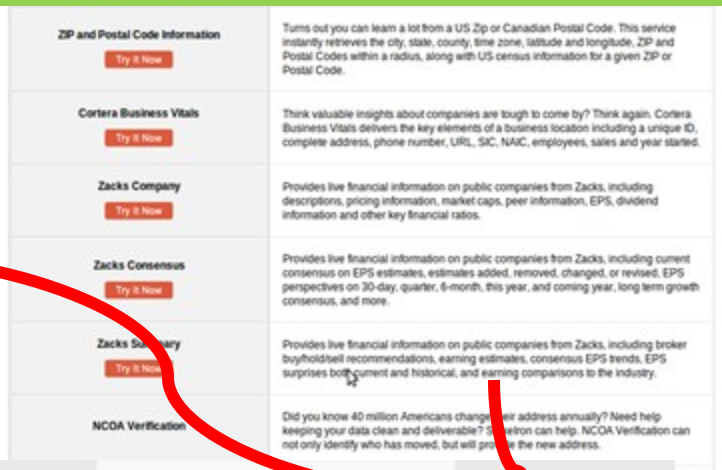
Domains: Retail & M2M
Places: Station, Shopping Centers, and Airports

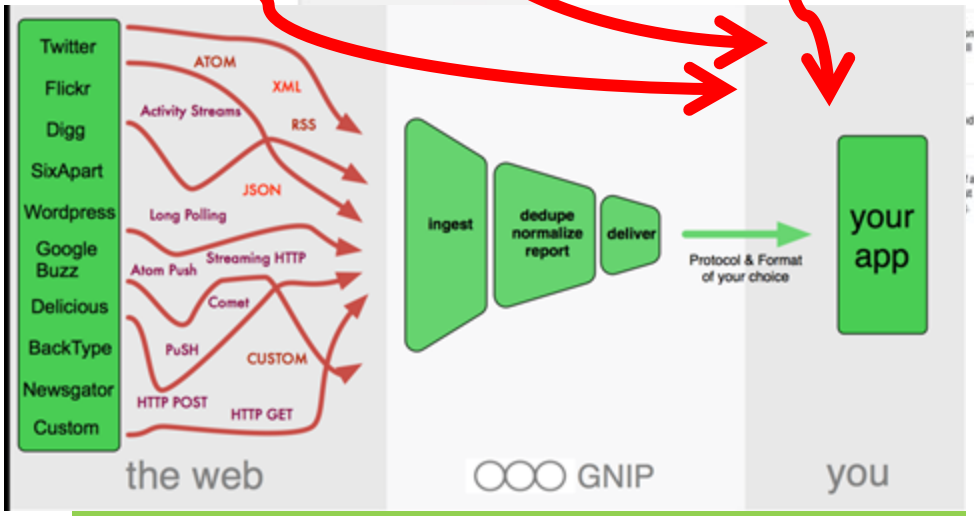
ASE – application examples (4)

Source: http://www.undata-api.org/



Source: http://www.strikeiron.com/Catalog/StrikeIronServices.aspx





Source: http://docs.gnip.com/w/page/23722723/Introduction-to-Gnip

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) Distributed Systems
    - Give you fundamental distributed system concepts and technologies
  - Distributed Systems Technologies:
    - Give you fundamental distributed technologies and how to use them
- **But they do not deal with engineering such large-scale, complex service-based systems**

Questions

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

What is the course about? (1)

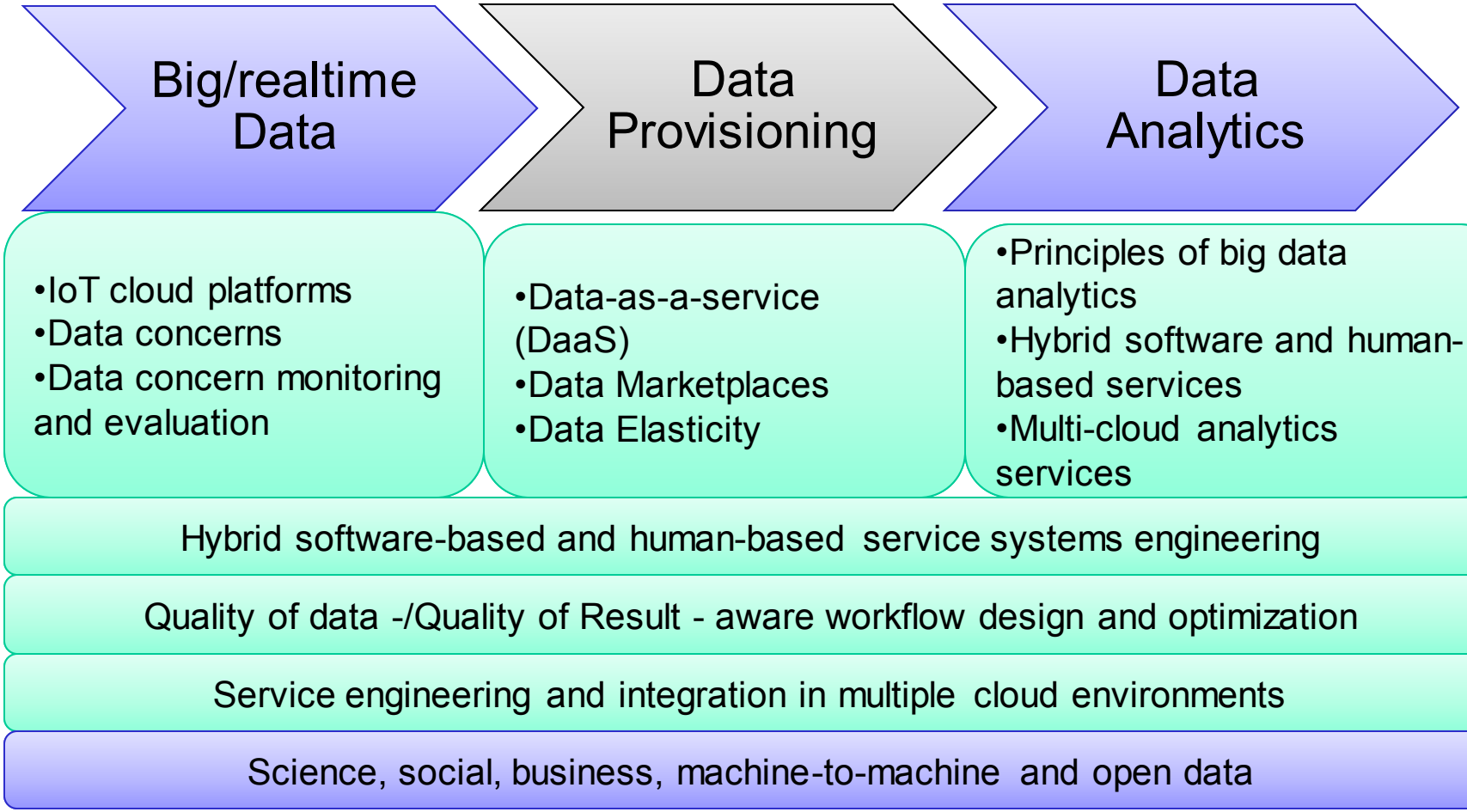
- Discuss new concepts and techniques for engineering advanced, Internet-scale, elastic service-based systems

- Focus on service systems for complex data analytics, programming elasticity, and principles for engineering IoT cloud systems and for social-physical cloud systems

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

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

What is the course about? (2)



EXAMPLES FROM PREIVOUS YEARS

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 framework (e.g., MapReduce/Hadoop)
- Relevant work in IoT, humans and software integration
- Distributed and Cloud computing
- Edge computing

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
  - http://tuwiendsg.github.io/
  - http://tuwiendsg.github.io/iCOMOT/

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

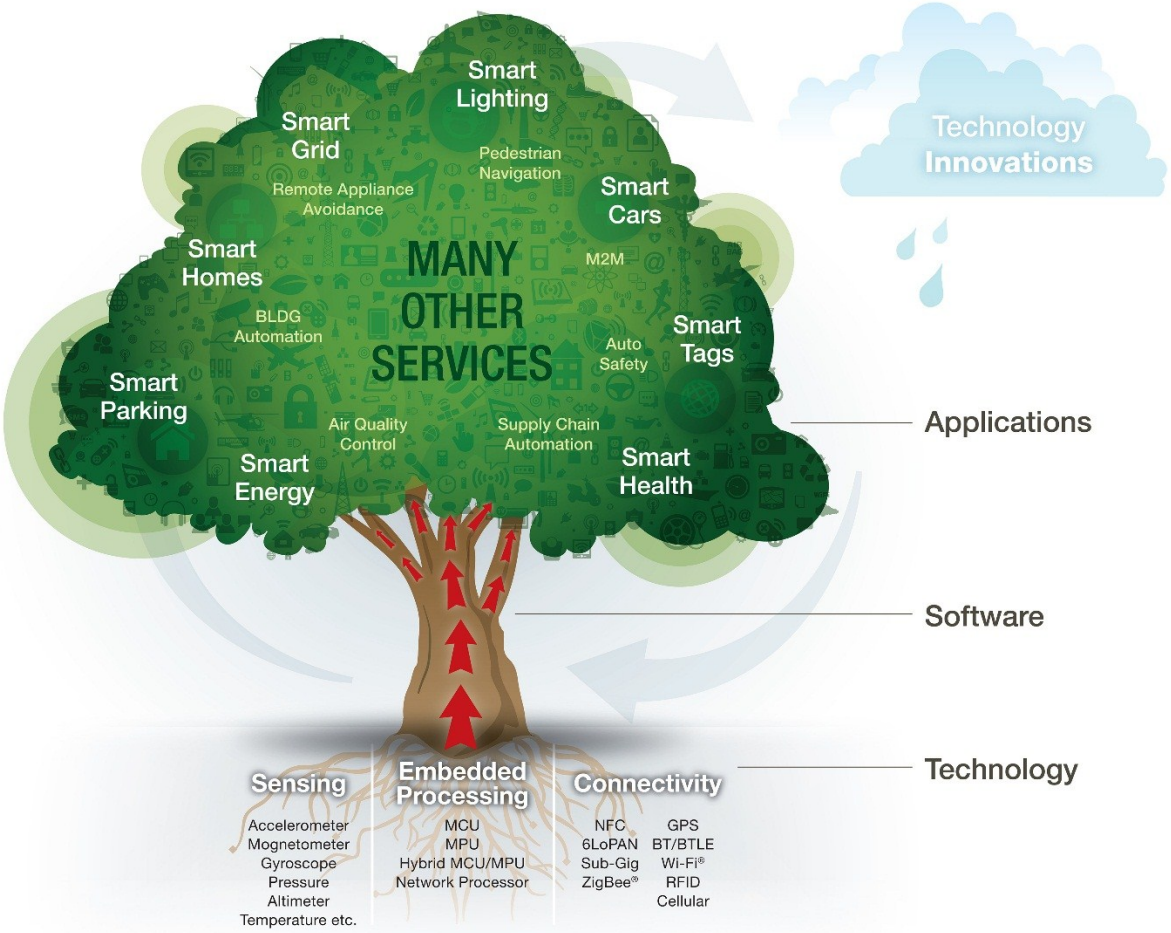
Course administration (3)

- 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, until Sep 2016)

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/AdvancedServicesEngineeringTUWien2016
- Some best results will be shown in the course website

Running out of topics for your mini projects?



Source: http://eecatalog.com/IoT/files/2014/04/Freescale-Internet-of-Things-Tree.jpg?file=2014/04/Freescale-Internet-of-Things-Tree.jpg

Grades

- Participations + discussions: 10 points
- Assignments: 40 points
- Mini project: 20 points
- 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! ANY QUESTION?

Thanks for your attention

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