Trends and Concepts in the Software Industry I
From On-Premise to the Cloud

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Enterprise Platform and Integration Concepts
Hasso-Plattner-Institut
Deep technical understanding of trends and concepts in enterprise computing, esp. main-memory-centric data management on modern hardware, cloud-native development, intelligent enterprises and their impact on applications.

Focus areas

- Principles of in-memory databases
- Characteristics and architecture of enterprise applications and systems
- Influence of cloud-native development
- Trends and challenges in enterprise computing
- Experience reports from industry
- Hands-on exercises and experiments
General information
- When: September (TBA, presumably hybrid format)
- Lectures given by Prof. Plattner
- Additional lectures by guests from industry
- Discussions about open questions in enterprise computing with knowledgeable experts are a vital part of the lecture!

Final grade consists of
- Preparation quiz (mandatory)
- Group work, presentation, and participation during the block week (40%)
- Oral exam (60%)

Course Overview
Block Week: September 2021
Course Overview
General Information

- 6 ECTS points
- Latest enrollment: 28\textsuperscript{th} of April 2021
- Modules
  - IT-Systems Engineering MA
    - ITSE-Konstruktion
    - ITSE-Maintenance
    - BPET-Konzepte und Methoden
    - BPET-Spezialisierung
    - BPET-Techniken und Werkzeuge
    - OSIS-Konzepte und Methoden
    - OSIS-Spezialisierung
    - OSIS-Techniken und Werkzeuge
  - Data Engineering MA
    - DATA-Konzepte und Methoden
    - DATA-Techniken und Werkzeuge
    - DATA-Spezialisierung
  - Digital Health MA
    - SCAD-Concepts and Methods
    - SCAD-Technologies and Tools
    - SCAD-Specialization
    - APAD-Concepts and Methods
    - APAD-Technologies and Tools
    - APAD-Specialization
  - Cybersecurity MA
    - IDMG-Konzepte und Methoden
    - IDMG-Techniken und Werkzeuge
    - IDMG-Spezialisierung

Slide 4
Course Overview
Schedule

- **Group Assignment**: 28th of April
- **Quiz Deadline**: 2nd of June
- **Summer Vacation**: in August
- **Prepare Meeting**: TBA September
- **Start Block Week**: One week later
- **End Block Week**: End of September
- **Exam**: End of September
- **Group Work & Prep**: One week later
Preparation
A Course in In-Memory Data Management

- Get a solid understanding of the fundamentals of In-Memory Data Management

- Materials
  - Course book (distributed digitally)
  - openHPI course
    - https://open.hpi.de/courses/tuk2021

- Mandatory quiz
  - Start: 28th of April
  - Deadline: 2nd of June
Plattner & Leukert: The In-Memory Revolution
How SAP HANA Enables Business of the Future

Reznik, Dobson & Gienow: Cloud Native Transformation: Practical Patterns for Innovation

Scholl, Swanson & Jausovec: Cloud Native: Using Containers, Functions, and Data to Build Next-Generation Applications
## Trends and Concepts in the Software Industry I
### From On-Premise to the Cloud

### Diagram

<table>
<thead>
<tr>
<th>On-Premise</th>
<th>Infrastructure-as-a-Service</th>
<th>Platform-as-a-Service</th>
<th>Software-as-a-Service</th>
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<tbody>
<tr>
<td>Applications</td>
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<td>Data</td>
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<td>Runtime</td>
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<td>Operating System</td>
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<td>Networking</td>
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</tbody>
</table>

- **Red**: You manage
- **Orange**: Service provider manages

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**Slide 9**
Enterprise

Different business applications run an enterprise

Platform

Platform for extending, integrating, and getting the most value out of business applications

Cloud

Cloud for running and managing provided services
Day 1: The In-Memory Revolution

Day 2: Cloud Impact on Enterprise Architecture

Day 3: In-Memory Goes Cloud

Day 4: Composing Cloud Applications
Preparation of interactive group part
- Teams of 6 to 8 students
- Regular meetings
- Team assignment: 28th of April

Hands-on experiments
- Familiarization with existing research
- Implementation parts
- Evaluation of the results
- Presentation in the block week (~30 minutes)

Tell us your topic preference: https://forms.gle/fRmZTTsVLGZ3fUgm9
Motivation

Clustering data in clusters with similar data characteristics allows for various performance improvements. When searching on sorted data, binary searches can be used over linear searches. Moreover, clustering often enables the database to skip large parts of the data without ever looking at it. However, finding a good clustering configuration is not trivial.

Challenges

▪ Understand the storage layout and architecture of modern in-memory systems
▪ Understand where clustering might be beneficial and in which cases not
▪ Analyze a given workload and automatically determine a good clustering scheme

Learnings

▪ First looks into the in-memory database Hyrise and its storage engine
▪ Proper Benchmarking
▪ How to make automated tuning decisions

Requirements

▪ Basic database knowledge (partitioning, filtering, SQL)
▪ Mostly scripting using Python and SQL
Motivation
The development of complex software systems is challenging and consequently not failure-free. The correction of software errors is costly and often requires time-consuming debugging sessions. Detailed knowledge about the evolution of defect reports and where failures are located (e.g., components, services, algorithms) allow us to understand our systems better and prevent future failures.

Challenges – Questions to be answered
- Understand failures and defects in real-world datasets of error tracking systems
- Develop visualization and analysis concepts to address questions such as:
  - Where are errors located?
  - How long does a failure exist?
  - How often has a ticket been reopened and how many authors are involved?
  - Are there interrelationships between failures?

Learnings
- SQL and scripting language
- Data analysis and visualization concepts

Requirements
- Basic programming skills
- Basic statistical knowledge

Group Work – Topic 2
Where Are Our Failures Located? - An Analysis of Error Reports

https://www.mediawiki.org/wiki/Bugzilla
Motivation
For any given application workload, there today is a variety of cloud-based database offerings. The underlying database systems are based on different architectures with respective tradeoffs. These need to be understood for an educated choice between the offerings. This year’s focus is on analytics.

Challenges
▪ Run a representative analytics workload on various cloud database offerings and interpret the results with respect to time and cost
▪ Tune a database system for a given workload, rinse and repeat
▪ Understand the architectures and tradeoffs of current database systems, i.e., be able to decide when to use what and to explain why

Learnings
▪ Hands-on experience with modern cloud databases
▪ Proper benchmarking

Requirements
▪ Basic database knowledge is expected
Motivation
When starting (and growing) a new company, there is a need for software support. Instead of buying a complete ERP product or relying on Excel sheets, business processes can be modeled and executed using process engines that automate and orchestrate workflows.

Challenges
- Get to know the workings of the open-source Camunda Platform process engine
- Implement a common SAP business process using the process engine
- Build the services and endpoints that are required and interacted with (in the languages of your choice)

Learnings
- Hands-on experience with a production process engine
- Understanding of real business processes

Requirements
- Basic knowledge of BPMN is expected
Your task is to analyze how customers currently develop with SAP cloud technology. Based on that, you rethink how they can improve their efficiency when developing with cloud technology under the assumption that any data is available globally with (almost) zero response time.

https://www.der-postillon.com/2017/05/aepfel-birnen.html
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Group Work & Prep

Block Week
Tell Us Your Topic Preference
Trends and Concepts in the Software Industry I - Exercises

https://forms.gle/fRmZTTsVLGZ3fUqm9
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