

# Ausgewählte Kapitel der Systemsoftware

## Skalierbare und energiebewusste Datenzentren

**Tobias Distler, Benedict Herzog, Michael Eischer**

Lehrstuhl für Informatik 4  
Verteilte Systeme und Betriebssysteme  
Friedrich-Alexander-Universität Erlangen-Nürnberg

Wintersemester 18/19

[https://www4.cs.fau.de/Lehre/WS18/MS\\_AKSS/](https://www4.cs.fau.de/Lehre/WS18/MS_AKSS/)



# Agenda

---

**Themen**

Organisatorisches



## ■ Machine Learning I



Martín Abadi, Paul Barham, Jianmin Chen, Zhifeng Chen, Andy Davis et al.  
**TensorFlow: A System for Large-Scale Machine Learning**  
*Proc. of 12th Symposium on Operating Systems Design and Implementation (OSDI '16)*, p. 265–283, 2016.



Yuan Yu, Martín Abadi, Paul Barham, Eugene Brevdo, Mike Burrows et al.  
**Dynamic Control Flow in Large-Scale Machine Learning**  
*Proc. of the 13th EuroSys Conference (EuroSys '18)*, p. 18:1–18:15, 2018.

## ■ Machine Learning II



Mu Li, David G. Andersen, Jun Woo Park, Alexander J. Smola, Amr Ahmed et al.  
**Scaling Distributed Machine Learning with the Parameter Server**  
*Proc. of 11th Symposium on Operating Systems Design and Implementation (OSDI '14)*, p. 583–598, 2014.



Eric P. Xing, Qirong Ho, Wei Dai, Jin Kyu Kim, Jinliang Wei, Seunghak Lee et al.  
**Petuum: A New Platform for Distributed Machine Learning on Big Data**  
*IEEE Transactions on Big Data*, 1(2):49–67, 2015.



## ■ Microservices & Serverless Computing



Gopal Kakivaya, Lu Xun, Richard Hasha, Shegufta Bakht Ahsan, Todd Pfeleger et al.  
**Service Fabric: A Distributed Platform for Building Microservices in the Cloud**  
*Proc. of the 13th European Conference on Computer Systems (EuroSys '18)*,  
p. 33:1–33:15, 2018.



Istemi Ekin Akkus, Ruichuan Chen, Ivica Rimac, Manuel Stein, Klaus Satzke et al.  
**SAND: Towards High-Performance Serverless Computing**  
*Proc. of the 2018 USENIX Annual Technical Conference (ATC '18)*,  
p. 923–935, 2018.

## ■ Distributed Ledgers & Blockchains



Elli Androulaki, Artem Barger, Vita Bortnikov, Christian Cachin et al.  
**Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains**  
*Proc. of the 13th European Conference on Computer Systems (EuroSys '18)*,  
p. 30:1–30:15, 2018.



Srinath Setty, Soumya Basu, Lidong Zhou, Michael Lowell Roberts et al.  
**Enabling Secure and Resource-Efficient Blockchain Networks with VOLT**  
*Technical Report MSR-TR-2017-38, Microsoft Research, 2017.*



## ■ Data-Stream Processing



Tyler Akidau, Alex Balikov, Kaya Bekiroğlu, Slava Chernyak, Josh Haberman et al.  
**MillWheel: Fault-Tolerant Stream Processing at Internet Scale**  
*Proc. of the VLDB Endowment*, 6(11):1033–1044, 2013.



Sanjeev Kulkarni, Nikunj Bhagat, Maosong Fu, Vikas Kedigehalli et al.  
**Twitter Heron: Stream Processing at Scale**  
*Proc. of the 41st International Conference on Management of Data (SIGMOD '15)*, p. 239–250, 2015.

## ■ Secure Computing with SGX



Felix Schuster, Manuel Costa, Cédric Fournet, Christos Gkantsidis et al.  
**VC3: Trustworthy Data Analytics in the Cloud using SGX**  
*Proc. of the 2015 IEEE Symposium on Security and Privacy (SP '15)*, p. 38–54, 2015.



Sergei Arnautov, Bohdan Trach, Franz Gregor, Thomas Knauth, Andre Martin et al.  
**SCONE: Secure Linux Containers with Intel SGX**  
*Proc. of 12th Symposium on Operating Systems Design and Implementation (OSDI '16)*, p. 689–703, 2016.



## ■ RDMA-based Storage Systems



Aleksandar Dragojević, Dushyanth Narayanan, Miguel Castro, and Orion Hodson  
**FaRM: Fast Remote Memory**

*Proc. of the 11th Symposium on Networked Systems Design and Implementation (NSDI '14)*, p. 401–414, 2014.



Yacine Taleb, Ryan Stutsman, Gabriel Antoniu, and Toni Cortes  
**Tailwind: Fast and Atomic RDMA-based Replication**

*Proc. of the 2018 USENIX Annual Technical Conference (ATC '18)*, p. 851–863, 2018.

## ■ NVM-based File Systems



Qingda Hu, Jinglei Ren, Anirudh Badam, Jiwu Shu, and Thomas Moscibroda  
**Log-Structured Non-Volatile Main Memory**

*Proc. of the 2017 USENIX Annual Technical Conference (ATC '17)*, p. 703–717, 2017.



Jian Xu, Lu Zhang, Amirsaman Memaripour, Akshatha Gangadharaiah et al.  
**NOVA-Fortis: A Fault-Tolerant Non-Volatile Main Memory File System**

*Proc. of the 26th Symposium on Operating Systems Principles (SOSP '17)*, p. 478–496, 2017.



## ■ Energy-Proportional Computing



David Lo, Liqun Cheng, Rama Govindaraju, Luiz André Barroso et al.  
**Towards Energy Proportionality for Large-Scale Latency-Critical Workloads**  
*Proc. of the 41st International Symposium on Computer Architecture (ISCA '14)*,  
p. 301–312, 2014.



George Prekas, Mia Primorac, Adam Belay, Christos Kozyrakis et al.  
**Energy Proportionality and Workload Consolidation for Latency-Critical Applications**  
*Proc. of the 6th Symposium on Cloud Computing (SoCC '15)*, p. 342–355, 2015.

## ■ Energy and Security in the Cloud



Helmut Hlavacs, Thomas Treutner, Jean-Patrick Gelas, Laurent Lefevre et al.  
**Energy Consumption Side-Channel Attack at Virtual Machines in a Cloud**  
*Proc. of the 9th International Conference on Dependable, Autonomic and Secure Computing (DASC '11)*, p. 605–612, 2011.



Massimo Ficco and Francesco Palmieri  
**Introducing Fraudulent Energy Consumption in Cloud Infrastructures: A New Generation of Denial of Service Attacks**  
*IEEE Systems Journal 11(2)*, p. 460–470, 2017.



## ■ Data Center Power Management



Qiang Wu, Qingyuan Deng, Lakshmi Ganesh, Chang-Hong Hsu, Yun Jin et al.  
**Dynamo: Facebook's Data Center-Wide Power Management System**  
*Proc. of the 43rd International Symposium on Computer Architecture (ISCA '16)*,  
p. 469–480, 2016.



Xiaobo Fan, Wolf-Dietrich Weber, and Luiz André Barroso  
**Power Provisioning for a Warehouse-sized Computer**  
*Proc. of the 34th International Symposium on Computer Architecture (ISCA '07)*,  
p. 13–23, 2007.

## ■ Power Monitoring



Daniel Hackenberg, Thomas Ilsche, Robert Schöne, Daniel Molka et al.  
**Power Measurement Techniques on Standard Compute Nodes:  
A Quantitative Comparison**  
*Proc. of the International Symposium on Performance Analysis of Systems and  
Software (ISPASS '13)*, p. 194–204, 2013.



Daniel Hackenberg, Robert Schöne, Thomas Ilsche, Daniel Molka et al.  
**An Energy Efficiency Feature Survey of the Intel Haswell Processor**  
*Proc. of the 29th International Parallel and Distributed Processing Symposium  
Workshops (IPDPSW '15)*, p. 896–904, 2015.





# Agenda

---

Themen

**Organisatorisches**



## ■ Betreuer

Tobias Distler



(Raum 0.039)

[distler@cs.fau.de](mailto:distler@cs.fau.de)

Benedict Herzog



(Raum 0.041)

[benedict.herzog@cs.fau.de](mailto:benedict.herzog@cs.fau.de)

Michael Eischer



(Raum 0.045)

[eischer@cs.fau.de](mailto:eischer@cs.fau.de)

## ■ Termin

Dienstag, 16:15-17:45 Uhr, Raum 0.035-113 (I4-Besprechungsraum)

## ■ Webseite

- Lehrveranstaltung: [https://www4.cs.fau.de/Lehre/WS18/MS\\_AKSS/](https://www4.cs.fau.de/Lehre/WS18/MS_AKSS/)
- Waffel: <https://waffel.informatik.uni-erlangen.de/signup?course=345>

## ■ Mailingliste

Bei Fragen, die alle betreffen: [akss@lists.informatik.uni-erlangen.de](mailto:akss@lists.informatik.uni-erlangen.de)



## ■ Einarbeitung

- Eigenständiges Erarbeiten eines Themas
- Literaturrecherche: Zwei Papiere als Ausgangsbasis

## ■ Ausarbeitung

- Erstellen einer Ausarbeitung (mindestens 6 Seiten)
- ACM Standard Proceedings Template (ACM SIG style)
- Berücksichtigen der [Wissensbasis](#)
- Sprache: Deutsch oder Englisch

## ■ Vortrag

- Foliensatz zur Ausarbeitung
- 30-minütiger Vortrag
- Etwa 15-minütige Diskussion
- Optional: i4-Beamertemplate
- Berücksichtigen der [Hinweise zur Erstellung der Folien](#)
- Sprache: Deutsch oder Englisch



## ■ Zeitlicher Ablauf

- **Erste Version der Ausarbeitung:** Drei Wochen vor der Präsentation
  - Per E-Mail an Betreuer
  - Feedback von Betreuer
- **Erste Version der Folien:** Zwei Wochen vor der Präsentation
  - Per E-Mail an Betreuer
  - Feedback von Betreuer
  - Rechtzeitig vor der Präsentation: Technikcheck
- **Finale Version der Ausarbeitung:** Freitag vor der Präsentation
  - Per E-Mail an Betreuer
  - Betreuer verteilt die Ausarbeitung über die Mailingliste

## ■ Arbeitsmittel und -organisation

- Verwendung von Git (<https://gitlab.cs.fau.de/>) empfohlen
- Abgabe der Ausarbeitungen und Folien per Git (bevorzugt) oder E-Mail



# Vorläufiger Semesterplan

---

16.10.18	Einführung
23.10.18	Lesen, Begutachten und Veröffentlichen von Fachliteratur
30.10.18	Arbeitstechnik und LaTeX
06.11.18	Vortragstechniken
<hr/>	
13.11.18	Papierdiskussion
20.11.18	Konferenzvortrag
27.11.18	Papierdiskussion
04.12.18	Konferenzvortrag
11.12.18	Papierdiskussion
<hr/>	
15.01.19	Secure Computing with SGX Energy and Security in the Cloud
29.01.19	Machine Learning Microservices & Serverless Computing
<hr/>	
05.02.19	Semesterabschluss

