AutoDC - Deliverable 5.7

Public project dissemination activity summary.

# Theses

1. M. Siltala, Simulating data center cooling systems: data-driven and physical modeling methods. Masters Thesis, Aalto University/RISE, <https://aaltodoc.aalto.fi/handle/123456789/43528>
2. R. Brännvall, Machine learning based control of small-scale autonomous data centers, Licentiate thesis, Luleå University of Technology/RISE, <http://ltu.diva-portal.org/smash/get/diva2:1445959/FULLTEXT01.pdf>
3. O. Linna, Feasibility study of autonomous data centers, Masters Thesis, Aalto University/Granlund, <http://urn.fi/URN:NBN:fi:aalto-201908254942>
4. X. Wang, “Dimensionality reduction for performance prediction in networked systems,” Master thesis, KTH Royal Institute of Technology, Stockholm, 2020.
5. H. Zhang, “Efficient learning on high-dimensional operational data,” Master thesis, KTH Royal Institute of Technology, Stockholm, 2020.
6. C. Teng, “Forecasting service metrics for network services,” Master thesis, KTH Royal Institute of Technology, Stockholm, 2020.
7. P. Vamshi, Efficient learning on high-dimensional operational data, Masters Thesis, KTH 2019

# Keynotes, presentations, and workshop organization:

1. Karl-Erik Årzén, keynote at the DTU High Tech Summit, DTU, Denmark, October 11, 2018
2. "1st Workshop on Fog Computing and the Internet of Things" organized by Karl-Erik Årzen as a part of the CPS - IoT WEEK in Montreal, Canada, April 15, 2019
3. "2nd Workshop on Fog Computing and the Internet of Things" organized by Anton Cervin ULUND as a part of the CPS - IoT WEEK in Sydney, Australia, April 2020
4. R. Stadler, Keynote at IEEE BlackSeaCom
5. R. Stadler, Distinguished Experts Panel at IEEE NOMS 2020
6. R. Stadler, Distinguished Experts Panel at IEEE CNSM 2020
7. The AutoDC project was included in the presentation "Control of Computer Systems" by Karl-Erik Årzén at the 40th International Summer School of Automatic Control Grenoble, France September, 09-13, 2019
8. The AutoDC project was included in a presentation on Control of Computer Systems by Karl-Erik Årzén at the Nordic IoT Summer School: Edge and Fog Computing, June 17-21, 2019, DTU, Denmark
9. T. B. Minde - Presentation at Datacenter Innovation Region 2019
10. T. B. Minde - AutoDC EDGE presentation at DataCentreWorld 2020
11. The AutoDC project was included in the presentation "Control of Computer Systems" by Karl-Erik Årzén at the 40th International Summer School of Automatic Control Grenoble, France September, 09-13, 2019

# Patents:

1. H. Larsson, J. Taghia, M. Ebrahimi, C. Lee, A. Johnsson, F. Moradi, “Enabling collaborative learning between heterogenous components”,
   1. PCT/EP2021/061245, 2021
2. A. Johnsson, R. Yanggratoke, “A method and apparatus for ML model execution in resource-constrained systems”,
   1. PCT/EP2021/052333, 2021
3. A. Johnsson, F. Moradi, J. Taghia, H. Larsson, “Feature coherence in transfer learning using domain knowledge”,
   1. PCT/SE2020/051178, 2020
4. A method and apparatus for selecting power-saving features to activate in virtualized base station
   * + PCT/IB2020/057932
5. Measurement reporting and configuration in communication networks,
   * + PCT/EP2020/06512
6. Source Selection based on Diversity for Transfer Learning,
   * + US 63/080,371
7. Methods and systems for dynamic service performance prediction using transfer learning,
   * + US 62/770,330
8. Improving performance modelling in dynamic clouds,
   * + PCT/SE2019/050672

# Publications (conferences and journals):

1. Fernando Garcia Sanz, Masoumeh Ebrahimi, and Andreas Johnsson, “On Heterogeneous Transfer Learning for Improved Network Service Performance Prediction”, IEEE Globecom, 2021.
2. H. Larsson, J. Taghia, F. Moradi, A. Johnsson, “Source Selection in Transfer Learning for Service Performance Prediction”, In Proceedings to IFIP Networking Conference (IFIP Networking) and Workshops, 2021.
3. H. Larsson, J. Taghia, F. Moradi, A. Johnsson, “Towards Source Selection in Transfer Learning for Cloud Performance Prediction”, In Proceedings to IFIP/IEEE Integrated Network Management (IM), 2021.
4. F. Moradi, et. al, “Performance Prediction in Dynamic Clouds using Transfer Learning”, In Proceedings to IFIP/IEEE IM, 2019
5. R. Brännvall, J. Sarkinen, J. Svartholm , J. Gustafsson, J. Summers, Digital Twin for tuning of Server Fan Controllers. Proceedings IEEE 17th International Conference on Industrial Informatics, INDIN 2019, 2019.
6. F. S. Samani , R. Stadler, C. Flinta , A. Johnsson , ”Conditional Density Estimation of Service Metrics for Networked Services”, Transactions of Network and Service Management, July 2019.
7. F. S. Samani, et. al., ”Demonstration: Predicting Distributions of Service Metrics”, In Proceedings to IFIP/IEEE IM
8. C. Flinta , W. Yan, A. Johnsson , “Predicting Round Trip Time Distributions in IoT Systems using Histogram Estimators”, IFIP/IEEE, September 2019.
9. C. Flinta, W. Yan, A. Johnsson, “Predicting Round-Trip Time Distributions in IoT Systems using Histogram Estimators”, IFIP/IEEE Network Operations and Management Symposium, 2020.
10. R. Stadler, “Data driven Network Engineering and Management”, Keynote address, IEEE BlackSeaCom , June 3 6, 2019, Sochi, Russia.
11. F. Shahab Samani , H. Zhang, R. Stadler, “Efficient Learning on High dimensional Operational Data”, 15th International Conference on Network and Service Management, Halifax, Canada, 21 25 October, 2019.
12. R. Brännvall, M. et.al. , EDGE microgrid data center with electricity and coolant storage, 8th International Workshop on Energy-Efficient Data Centres (E2DC 2020), Melbourne, Australia (virtual due to covid-19)
13. Millnert, V., E. Bini, and J. Eker. “AutoSAC: automatic scaling and admission control of forwarding graphs”. In: Annals of Telecommunications 73.3-4 (2018), pp. 193–204.
14. Millnert, V., E. Bini, and J. Eker. “Cost minimization of network services with buffer and end-to-end deadline constraints”. In: ACM SIGBED Review 14.4 (2018), pp. 39–45.
15. Millnert, V., J. Eker, and E. Bini. “Achieving predictable and low end-to-end latency for a network of smart services”. In: IEEE GLOBECOM 2018. 2018.
16. Victor Millnert, Johan Eker, Enrico Bini. "End-to-end deadlines over dynamic topologies" 31st Euromicro Conference on Real-Time Systems, Stuttgart, Germany 2019
17. Skarin, P., W. Tärneberg, K. Årzen, and M. Kihl. “Towards Mission-Critical Control at the Edge and Over 5G”. In: 2018 IEEE International Conference on Edge Computing (EDGE). July 2018, pp. 50–57.
18. Per Skarin, Johan Eker, Karl-Erik Årzén. "Cloud-based model predictive control with variable horizon", 21st World Congress of the International Federation of Automatic Control, 2020
19. Per Skarin, Johan Eker, Maria Kihl and Karl-Erik Årzén. "Cloud-Assisted Model Predictive Control"
20. 2019 IEEE International Conference on Edge Computing (EDGE)
21. Karl-Erik Årzén, Per Skarin, William Tärneberg, Maria Kihl. "Control Over the Edge Cloud - An MPC Example" 1st Int. Workshop on Trustworthy and Real-time Edge Computing for CPS, Nashville, US
22. Johan Ruuskanen, Haorui Peng, Alexandre Martins. "Latency prediction in 5G for control with deadtime compensation", IoT-Fog '19, 1st Workshop on Fog Computing and the Io, Montreal, Canada, 2019
23. Victor Millnert, Johan Eker, Enrico Bini. "End-to-end deadlines over dynamic topologies"31st Euromicro Conference on Real-Time Systems, Stuttgart, Germany, July 2019
24. Per Skarin, Johan Eker, Karl-Erik Årzén. "Cloud-based model predictive control with variable horizon" In submission to 21st World Congress of the International Federation of Automatic Control, 2020
25. Per Skarin, Johan Eker, Maria Kihl and Karl-Erik Årzén. "Cloud-Assisted Model Predictive Control" 2019 IEEE International Conference on Edge Computing (EDGE), July 2019
26. Abdelzaher, Tarek ; Hao, Yifan ; Jayarajah, Kasthuri ; Misra, Archan ; Yao, Shuochao ; Skarin, Per; Weerakoon, Dulanga and Årzén, Karl-Erik. "Five Challenges in Cloud-Enabled Intelligence and Control", ACM Transactions on Internet Technology, 2020
27. T. Nylander, J. Ruuskanen, K.-E. Årzén, M. Maggio. "Modeling of Request Cloning in Cloud Server Systems using Processor Sharing", 11th ACM/SPEC International Conference on Performance Engineering (ICPE), Edmonton, Canada, April 2020
28. Tommi Nylander, Johan Ruuskanen, Karl-Erik Arzen and Martina Maggio "Towards Performance Modeling of Speculative Execution for Cloud Applications", 3rd Workshop on Hot Topics in Cloud Computing Performance, Edmonton, Canada, April 21, 2020
29. Gautham Nayak Seetanadi and Karl-Erik Arzen. "Routing using Safe Reinforcement Learning", 2nd Workshop on Fog Computing and the Internet of Things", CPS - IoT WEEK, Sydney, Australia, April 2020
30. X. Wang, F. Shahab Samani, R. Stadler: “Online feature selection for rapid, low-overhead learning in networked systems,” 6th IFIP/IEEE International Conference on Network and Service Management, 2-6 November 2020.
31. Chemouil, P., Hui, P., Kellerer, W., Limam, N., Stadler, R. and Wen, Y., Guest Editorial Special Issue on Advances in Artificial Intelligence and Machine Learning for Networking. IEEE Journal on Selected Areas in Communications, 38(10), pp.2229-2233. 2020.
32. Chemouil, P., Hui, P., Kellerer, W., Li, Y., Stadler, R., Tao, D., Wen, Y. and Zhang, Y., Special issue on artificial intelligence and machine learning for networking and communications. IEEE Journal on Selected Areas in Communications, 37(6), pp.1185-1191.2019.
33. R. Brännvall, J. Kristiansson, F. Sandin, "Cross-Entropy Optimization and Control under Homomorphic Encryption”, 2021 Swedish Artificial Intelligence Society Workshop (SAIS 2021)
34. Gummesson Atroshi, J, Le, Ch., ”Automatic Log Based Anomaly Detection in Cloud Operations using Machine Learning”, Master’s thesis, Lund University, April, 2021.
35. Millnert, V., Eker, J “HoloScale: horizontal and vertical scaling of cloud resources”, Proceedings of 2020 IEEE/ACM 13th International Conference on Utility and Cloud Computing (UCC). 2020.
36. Heimerson, A., Brännvall, R., Sjölund, J, Eker, J., and Gustafsson, J., ”Towards a Holistic Controller:Reinforcement Learning for Data Center Control”, 9th International Workshop on Energy-Efficient Data Centres, E2DC 2021.
37. Olli-Pekka Rinta-Koski, Miki Sirola, Le Ngu Ngyen, Jaakko Hollmén. State discovery and prediction from multivariate sensor data. In Advanced analytics and learning on temporal data. Lecture Notes in Artificial Intelligence. Springer. In press

# Awards

1. Andreas Johnsonn, Rolf Stadler and Farnaz won another price with their paper ”Performance Prediction in Dynamic Clouds using Transfer Learning” which got ”best paper award” på IEEE/IFIP IM 2019.
2. The new price from 2020 is the ”**CNOM Best Paper Award**” and is awarded the best paper within network management under 2018 and 2019 at the following conferences:
   * IFIP/IEEE Integrated Management Symposium (IM) – 2019
   * IEEE/IFIP Network Operations and Management Symposium (NOMS) – 2018
   * International Conference on Network and Service Management (CNSM) – 2018 and 2019
   * Asia-Pacific Network Operations and Management Symposium (APNOMS) – 2019
   * Latin-America Network Operations and Management Symposium (LANOMS) – 2019
   * IEEE Conference on Network Softwarization (NetSoft) – 2018 and 2019
   * Conference on Innovation in Clouds, Internet and Networks (ICIN) – 2018 and 2019
   * Conference on Network of the Future (NoF) – 2018 and 2019
   * Conference on the Design of Reliable Communication Networks (DRCN) – 2018 and 2019
   * International Teletraffic Congress (ITC) – 2018 and 2019
   * Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS) – 2019
   * IEEE International Conference on Communications (ICC) – 2018 and 2019
   * IEEE Global Communications Conference (GLOBECOM) – 2018 and 2019
3. Tor Björn Minde among the “Top 30 Edge Computing Leaders” in the respected paper “Data economy”

