

# **12th International Conference on Cloud Computing and Services Science (CLOSER 2022)**

Online  
27 - 29 April 2022

## **Editors:**

**Maarten van Steen  
Donald Ferguson  
Claus Pahl**

ISBN: 978-1-7138-5289-6

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2022) by SCITEPRESS – Science and Technology Publications, Lda.  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2022)

For permission requests, please contact SCITEPRESS – Science and Technology Publications, Lda.  
at the address below.

SCITEPRESS – Science and Technology Publications, Lda.  
Avenida de S. Francisco Xavier, Lote 7 Cv. C,  
2900-616 Setúbal, Portugal

Phone: +351 265 520 185

Fax: +351 265520 186

[info@scitepress.org](mailto:info@scitepress.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# CONTENTS

---

## INVITED SPEAKERS

### KEYNOTE SPEAKERS

15 Years of Cloud Control <i>Erik Elmroth</i>	5
Data Security and Privacy in Emerging Scenarios <i>Pierangela Samarati</i>	7
Scaling the Data Loop: Accelerating the Development and Testing of Autonomous Vehicles <i>Ulrich Homann</i>	9

### PAPERS

#### FULL PAPERS

Performance of Databases Used in Data Stream Processing Environments <i>Manuel Weißbach and Thomas Springer</i>	15
Semantic Code Clone Detection Method for Distributed Enterprise Systems <i>Jan Svacina, Vincent Bushong, Dipta Das and Tomas Cerny</i>	27
Analysis and Rewrite of Quantum Workflows: Improving the Execution of Hybrid Quantum Algorithms <i>Benjamin Weder, Johanna Barzen, Martin Beisel and Frank Leymann</i>	38
Live Migration of Containers in the Edge <i>Rohit Das and Subhajit Sidhanta</i>	51
Offline Mining of Microservice-based Architectures <i>Jacopo Soldani, Javad Khalili and Antonio Brogi</i>	63
Predicting and Avoiding SLA Violations of Containerized Applications using Machine Learning and Elasticity <i>Paulo Souza, Miguel Neves, Carlos Kayser, Felipe Rubin, Conrado Boeira, João Moreira, Bernardo Bordin and Tiago Ferreto</i>	74
A Novel Weight-assignment Load Balancing Algorithm for Cloud Applications <i>Adekunbi A. Adewojo and Julian M. Bass</i>	86
Automated Generation of Application Management Workflows using TOSCA Policies <i>Domenico Calcaterra and Orazio Tomarchio</i>	97
Comparison of FaaS Platform Performance in Private Clouds <i>Marcelo Augusto Da Cruz Motta, Leonardo Reboucas De Carvalho, Michel Junio Ferreira Rosa and Aleteia Patricia Favacho De Araujo</i>	109

## SHORT PAPERS

Evaluation of Language Runtimes in Open-source Serverless Platforms <i>Karim Djemame, Daniel Datsev and Vasilios Kelefouras</i>	123
Cloud Function Lifecycle Considerations for Portability in Function as a Service <i>Robin Hartauer, Johannes Manner and Guido Wirtz</i>	133
Saga Pattern Technologies: A Criteria-based Evaluation <i>Karolin Dürr, Robin Lichtenthäler and Guido Wirtz</i>	141
Reconstructing the Holistic Architecture of Microservice Systems using Static Analysis <i>Vincent Bushong, Dipta Das and Tomas Cerny</i>	149
From the Sky to the Ground: Comparing Fog Computing with Related Distributed Paradigms <i>Joao Bachiega Jr., Breno Costa, Leonardo R. Carvalho, Victor H. C. Oliveira, William X. Santos, Maria Clícia S. de Castro and Aleteia Araujo</i>	158
Secure Scheduling of Scientific Workflows in Cloud <i>Shubhro Roy, Arun Ramamurthy, Anand Pawar, Mangesh Gharote and Sachin Lodha</i>	170
Towards a Performance Model for Byzantine Fault Tolerant Services <i>Thomas Loruenser, Benjamin Rainer and Florian Wohnert</i>	178
Communication Aware Scheduling of Microservices-based Applications on Kubernetes Clusters <i>Angelo Marchese and Orazio Tomarchio</i>	190
Optimal Placement of Micro-services Chains in a Fog Infrastructure <i>Claudia Canali, Giuseppe Di Modica, Riccardo Lancellotti and Domenico Scotece</i>	199
DISDA: Digital Service Design Architecture for Smart City Ecosystems <i>Mouzhi Ge and Barbora Buhnova</i>	207
Planning for Software System Recovery by Knowing Design Limitations of Cloud-native Patterns <i>Alireza Hakamian, Floriment Klinaku, Sebastian Frank, André van Hoorn and Steffen Becker</i>	215
Real-time Statistical Log Anomaly Detection with Continuous AIOps Learning <i>Lu An, An-Jie Tu, Xiaotong Liu and Rama Akkiraju</i>	223
A Research-backed Extended Taxonomy for Cloud Computing Elasticity <i>Raouia Bouabdallah</i>	231
Mobile Games at the Edge: A Performance Evaluation to Guide Resource Capacity Planning <i>Gabriel Araújo, Carlos Brito, Leonel Correia, Tuan Anh Nguyen, Jae Woo Lee and Francisco Airton Silva</i>	238
Total Cost Modeling for VNF based on Licenses and Resources <i>Ghoshana Bista, Eddy Caron and Anne-Lucie Vion</i>	246
Scalable Infrastructure for Workload Characterization of Cluster Traces <i>Thomas van Loo, Anshul Jindal, Shajulin Benedict, Mohak Chadha and Michael Gerndt</i>	254
Latency Assessment of Blockchain-based SSI Applications Utilizing Hyperledger Indy <i>Hamza Baniata, Tamas Pflanzner, Zoltan Feher and Attila Kertesz</i>	264
Porting Non Cloud-native Applications across Linux Distributions: A Practical Approach <i>Sanjeet Kumar and Suvrojit Das</i>	272

Multivariate Interpolation at the Edge to Infer Faulty IoT Sensor Metrics <i>Marcos Paulo Konzen, Patric Lincoln Ramires Izolan, Fábio Júnior Griesang, Paulo Silas Severo De Souza, Tiago Coelho Ferreto, Arthur Francisco Lorenzon, Marcelo Caggiani Luizelli, Julio Carlos Balzano De Mattos, Cinara Ewerling Da Rosa and Fábio Diniz Rossi</i>	280
Latency-aware Privacy-preserving Service Migration in Federated Edges <i>Paulo Souza, Ângelo Crestani, Felipe Rubin, Tiago Ferreto and Fábio Rossi</i>	288
Multi-cloud Load Distribution for Three-tier Applications <i>Adekunbi A. Adewojo and Julian M. Bass</i>	296
A Quality-driven Machine Learning Governance Architecture for Self-adaptive Edge Clouds <i>Claus Pahl, Shelernaz Azimi, Hamid R. Barzegar and Nabil El Ioini</i>	305
Orama: A Benchmark Framework for Function-as-a-Service <i>Leonardo Reboucas De Carvalho and Aleteia Patricia Favacho Araujo</i>	313
AUTHOR INDEX	323