**Dear Dr. Atakan Aral,**

I am writing to express my strong interest in the postdoctoral researcher job in Edge Computing, IoT, and Edge AI at the University of Vienna, which was offered on [Platform where you viewed the ad]. With a Ph.D. in Computer Engineering from the University of Tabriz and extensive experience in research, teaching, and software development, I am enthusiastic to contribute to your cutting-edge research and improve the field of edge computing.   
My dissertation study aimed to improve the performance and efficiency of cloud computing systems by creating novel scheduling and resource provisioning algorithms for scientific activities.

My dissertation, "QoS-aware Scheduling and Resource Provisioning for Scientific Workflows in Cloud Environments," looked into important trade-offs between performance, cost, and energy usage, and I published my findings in high-impact journals such as IEEE Transactions on Cloud Computing. These research experiences have given me a solid grasp of distributed systems, resource management, and performance optimization, which are all extremely relevant to the difficulties and opportunities posed by edge computing.   
Furthermore, my research used formal approaches, such as Colored Petri Nets, to model and analyze complicated systems. This technique encouraged a rigorous and systematic approach to system design, allowing me to efficiently address the challenges of heterogeneous, real-time systems, which are common in IoT and edge computing contexts.

* My qualifications and contributions support my eligibility for this position:   
  • **Expertise in Distributed Systems and Edge Computing**: My research focuses on:
  + **Resource Allocation**: Created and tested scheduling techniques to maximize resource consumption and reduce costs in multi-cloud scenarios, offering useful insights for resource-constrained edge nodes.
  + **Performance Optimization**: Used CloudSim to evaluate distributed system performance and make data-driven design decisions for efficient edge computing.
* **Proficient in Software Development**: With experience in back-end Python and Go development, as well as knowledge of frameworks like Django and Echo, I am well-equipped to create and deploy real-world computing solutions. I've also worked on projects using search engine databases such as Elasticsearch and Large Language Models (LLMs), including creating a search engine with a question-and-answer system using PostgreSQL. Furthermore, I am skilled at designing and implementing scalable APIs, databases, and data processing pipelines, all of which are necessary for dealing with the complexities of edge and IoT systems.
* **Academic** **Leadership and Mentorship**: As an Assistant Professor, I have successfully taught advanced courses such as Architecture of Large-scale Systems and Information Security Basics, as well as guided students through cloud and edge computing research projects. This experience improved my educational and mentoring skills, allowing me to effectively express complex topics and establish collaborative research environments.
* **Active involvement in the scientific community** as a reviewer for journals such as IEEE, Cluster Computing, and Computing keeps me up-to-date on the newest achievements. This critical appraisal of research helps to maintain high standards in the academic community and promotes a constant learning mindset.

I am particularly interested in the University of Vienna's renowned research environment and your team's substantial contributions to edge intelligence. I am excited to contribute to research projects that solve crucial difficulties in edge computing, such as:

• **Developing Energy-Efficient Edge Computing** **methods** to reduce energy usage and retain excellent performance in resource-constrained scenarios.   
• **Improved IoT security** by designing lightweight and robust frameworks to secure data integrity and confidentiality in decentralized networks, while addressing edge device vulnerabilities.   
• **Advancing Edge AI**: Using federated learning to deliver real-time, distributed intelligence in IoT networks, allowing for smooth data processing and decision-making across edge nodes.

I am convinced that my research experience, technological skills, and strong work ethic will benefit your research team. I am thrilled to learn from your excellent colleagues and help promote edge computing research at the University of Vienna.   
Thank you for your time and attention. I have attached my CV for your perusal and would appreciate the opportunity to discuss my qualifications further during an interview.   
Sincerely,

Ahmad Taghinezhad-Niar, Ph.D.

University of Tabriz

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My PhD thesis:

|  |
| --- |
| **Surname:** Taghinezhad-Niar **Name:** Ahmad |
| **Thesis Title** QoS-aware Scheduling and Resource Provisioning for Scientific Workflows in Cloud |
| **Supervisor:** Dr. Saeid Pashazadeh |
| **Advisor:** Dr. Javid Taheri |
| **Degree:** PhD **Major:** Computer Engineering **Field:** Software **Faculty:** Electrical and Computer Engineering **University:** University of Tabriz **Pages:** 134 **Graduation Date:** December 2021 |
| **Keywords:** Cloud Computing, Scheduling, Energy, Deadline, Budget, Workflow |
| **Abstract:** With the advancement of science and the rise of data, the need for computer resources and storage has increased more than ever. Cloud computing is known as a suitable solution to execute scientific computations. Scientific computations as workflows are submitted to the cloud for scheduling and execution. The problem of scheduling on heterogeneous resources is a complex NP-complete problem. Workflow scheduling is critical to the profitability of cloud providers and their user satisfaction. Many studies have addressed the problem of workflow scheduling in distributed systems. Due to the elasticity, varied pricing models, and heterogeneous resources, the problem of scheduling in the cloud is more challenging. Typically, studies focus on one or two scheduling objectives with financial or deadline limitations and energy consumption, as these are important concerns for both customers and cloud providers. Furthermore, most proposed solutions assume task execution time as a constant and precisely predictable quantity, which is an impractical assumption in the real cloud environment due to fluctuations in resource performance. Also, executing multiple workflows necessitates the establishment of containers on the resources due to provide an executable environment for each workflow, resulting in a delay in task execution that is not generally considered by researches. To this end, this thesis examines and proposes solutions for scheduling workflows in the cloud under different constraints such as budget and deadline, considering various evaluation metrics such as resource rental cost, makespan, resource utilization, and energy consumption using heuristic methods. We also propose methods for addressing cloud resource performance fluctuations and its negative impact on user constraints. The proposed workflow scheduling methods are evaluated against state-of-the-art researches using various workflows under different constraints and circumstances. The results demonstrate that the proposed methods significantly improve the success rate of meeting user constraints and obtaining higher evaluation metrics under different circumstances such as various deadline and budget constraints, container provisioning delay, and variation of resource performance. |

Papers

1. Security, Reliability, Cost, and Energy-Aware Scheduling of Real-Time Workflows in Compute-Continuum Environments

Ahmad Taghinezhad-Niar and Javid Taheri *, Senior Member, IEEE*

***Abstract*—Emerging computing paradigms like mist, edge, and fog computing address challenges in the real-time processing of vast Internet of Things (IoT) applications. Alongside, cloud computing offers a suitable platform for executing services. Together, they form a multi-tier computing environment known as compute-continuum to efficiently enhance data management and task execution of real-time tasks. The primary considerations for compute-continuum include variations in resource configuration and network architecture, rental cost model, application security needs, energy consumption, transmission latency, and system reliability. To address these problems, we propose two scheduling algorithms (RCSECH and RSECH) for real-time multi-workflow scheduling frameworks. Both algorithms optimize for rental cost, energy consumption, and task reliability when scheduling realtime workflows while considering deadlines and security requirements as constraints. RCSECH also factors in reliability alongside these constraints. The environment under investigation consists of a compute-continuum architecture consisting of mist, edge, fog, and cloud layers, each potentially composed of heterogeneous resources. The framework undergoes evaluation via simulation experiments, revealing promising results. Specifically, the framework exhibits the capability to enhance reliability by up to 7%, reduce energy consumption by 8%, surpass reliability constraints by more than 25%, and generate cost savings by at least 15%.**

1. Reliability, Rental-Cost and Energy-Aware Multi-Workflow Scheduling on Multi-Cloud Systems

Ahmad Taghinezhad-Niar and Javid Taheri , Senior Member, IEEE

Abstract—Computationally intensive applications with a wide range of requirements are advancing to cloud computing platforms. However, with the growing demands from users, cloud providers are not always able to provide all the prerequisites of the application. Hence, flexible computation and storage systems, such as multi-cloud systems, emerged as a suitable solution. Different charging mechanisms, vast resource configuration, different energy consumption, and reliability are the key issues for multi-cloud systems. To address these issues, we propose a multi-workflow scheduling framework for multi-cloud systems, intending to lower the monetary cost and energy consumption while enhancing the reliability of application execution. Our proposed platform presents different methods (utilizing resource gaps, the DVFS utilized method, and a task duplication mechanism) to ensure each application’s requirement. The Weibull distribution is used to model task reliability at different resource fault rates and fault behavior. Various synthetic workflow applications are used to perform simulation experiments. The results of the performance evaluation demonstrated that our proposed algorithms outperform (in the terms of resource rental cost, efficient energy consumption, and improved reliability) state-of-the-art algorithms for multi-cloud systems

1. State-Space Analysis and Complexity Assessment of Puzzle Games Using Colored Petri Nets

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ABSTRACT

The verification of complex systems has traditionally relied on semi-automatic theorem-proving methods. However, model checking represents a paradigm shift by enabling automated, exhaustive verification of behavioral properties through systematic state exploration. Among advanced formal verification tools, Colored Petri Net (CPN) stands out for its integration of the ML programming language, facilitating robust model checking and system validation. Nevertheless, the application of CPN to complex systems is often constrained by the state-space explosion problem, which presents a significant challenge in contemporary research. While state-space analysis offers powerful capabilities for validation and scenario extraction, its potential remains largely untapped due to computational complexity constraints. This limitation is particularly pronounced in concurrent systems with multiple interacting variables, exemplified by game systems where intricate rule sets, deadlock conditions, and termination scenarios demand sophisticated modeling approaches. This paper presents a novel methodological framework for modeling and analyzing such game riddles, introducing methods to mitigate the state-space explosion problem. We demonstrate the efficacy of our approach through a comprehensive case study of the Merchant Ship puzzle game, though the methodology generalizes across various game typologies. By synthesizing model-checking techniques with ML-based algorithmic implementations, we develop an optimized search strategy for traversing the state space graph, enabling the derivation of quantitative complexity metrics. These metrics encompass critical indicators such as the success- to-total scenario ratio and the minimal trajectory length for both successful and unsuccessful game completions. Our research contributes to both the theoretical understanding of game complexity analysis and practical applications in game design through formal methods

1. QoS-aware online scheduling of multiple workflows under task execution time uncertainty in clouds

Ahmad Taghinezhad-Niar1 • Saeid Pashazadeh1 • Javid Taheri2

Abstract Cloud computing, with elasticity and pay-as-you-go pricing, is a suitable platform for executing workflow applications. Workflow as a Service (WaaS) systems provide scientists with an easy-to-use, and cost-effective platform to execute their workflow applications in the cloud at any time or location worldwide. Quality of Service (QoS) is recognized as a key requirement in WaaS. Monetary cost and time are two primary QoS from a clients’ perspective; whereas, energy con- sumption is considered a significant problem for cloud providers’ profitability and ability to provide low-cost services. Most workflow scheduling studies assume that workflow tasks have a deterministic Execution Time (ET), which is generally unrealistic in the real world. However, there are few approaches for scheduling in WaaS considering deadlines, and monetary costs with uncertain task ET. These studies typically assume that a cloud resource can execute all types of workflow applications without any need for additional software components. However, using containers is a suitable so- lution to provide an executable environment for the execution of any workflow type on cloud resources. To this end, we present two cost and energy-aware workflow scheduling that consider the uncertainty in tasks’ ETs. Both solutions are designed for WaaS, leveraging containers to enhance resource utilization rate and reduce energy consumption, resource monetary cost, and workflows deadline violations. Simulated experiments demonstrate that our proposed methods out- perform two recent state-of-the-art scheduling algorithms in terms of success rate, monetary cost, energy consumption, and resource utilization rate.

Keywords

1. Energy-efficient workflow scheduling with budget-deadline constraints for cloud

**Ahmad Taghinezhad-Niar1 · Saeid Pashazadeh · Javid Taheri**

**Abstract**

Cloud computing has become a well-known platform for solving big data and complex problems such as workflow applications. Infrastructure as a Service (IaaS) from the cloud is a suitable platform to solve these problems as it can potentially provide a nearly unlimited amount of resources using virtualization technology with a pay-peruse costmodel.VariousQuality of Service(QoS) objectives, such as cost and time, have been considered individually for workflow scheduling. In this paper, we proposed two energy-efficient heuristic algorithms with budget-deadline constraints that are appropriate for resources with Dynamic Voltage and Frequency Scaling (DVFS) enabled, as well as those that do not supportDVFS. They are BudgetDeadline Constrained Energyaware (BDCE) and Budget Deadline DVFS-enabled energy-aware (BDD) algorithms for the cloud. Furthermore, they acquire affordable cost, faster scheduling length, and higher energy-saving ratio. Various evaluation metrics like success rate, cost and time ratios, energy consumption, utilization rate, and energy-saving ratio are utilized to evaluate the performance of the proposed algorithms. The obtained results are compared with budget-deadline constraintsmethods, such as BDSD, DBCS, and BDHEFT, as well as two other energy-efficient deadline-constrained algorithms, namely, E