Introduction: Cloud continuum: technologies and applications

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Antonio Esposito is currently a research fellow at the Department of Engineering of the University of Campania 'Luigi Vanvitelli', Italy. His PhD thesis focused on the recognition and application of design and cloud patterns to software development in cloud environments, with the support of semantic technologies. He has been involved in the EU-funded FP7-ICT Project mOSAIC, in the Horizon 2020 Project Toreador, in the Horizon 2020 project GreenCharge and in the applied research project 'Big Data Giustizia e Datawarehouse', promoted by the Italian Ministry of Justice as part pf the Consorzio Interuniversitario Nazionale per l'Informatica (CINI).

1 Introduction

The rapid advancements in cloud computing and its associated technologies have revolutionised the IT industry, introducing disruptive changes and offering new and innovative services to users. Cloud computing has provided cost-effective access to computing resources, enabling organisations to streamline their operations and leverage scalable and flexible solutions. With the emergence of the internet of things (IoT) and the availability of ubiquitous, distributed computational resources, the cloud paradigm has further evolved, giving rise to concepts such as edge computing and the cloud continuum. The fast evolution of IoT, edge computing and cloud continuum technologies has also brought several challenges and issues that need to be addressed, especially in relation to security and interoperability (Di Martino et al., 2028; Bittencourt et al., 2018). The cloud continuum represents a paradigm shift in the way computing services are delivered and used. It leverages the combined power of cloud computing, edge computing, and IoT technologies to support an ever-increasing number of applications across various domains (Di Martino et al., 2020; Liu et al., 2023; Li et al., 2023; Zappatore et al., 2023). One such domain that has greatly benefited from the advancements in cloud technologies is public transportation and mobility.

Public transportation and mobility play a vital role in modern societies, enabling efficient movement of people and goods, reducing congestion, and promoting sustainable transportation practices. The application of the cloud continuum in this domain has the potential to revolutionise the way transportation systems operate, enhance user experiences, and optimise resource management. However,

there are both challenges and technological limitations that need to be addressed to fully leverage the potential of the cloud continuum in the context of public transportation and mobility. The definition of new programming paradigms, especially addressing cloud edge environments, represents a first step towards this objective (Villari et al., 2016).

The scope of this special issue is to provide valuable insights into the application of the cloud continuum, with a specific focus on public transportation and mobility. It aims to shed light on the main challenges faced by these domains and explore the technological limits that the cloud continuum currently encounters. Additionally, this special issue aims to highlight the ongoing research activities that are being carried out to overcome these challenges and push the boundaries of the cloud continuum in the context of public transportation and mobility.

The topics covered in this special issue include, but are not limited to, user perception and economic analysis of e-mobility services, travel demand estimation using big data and cloud computing, integration of energy-efficient components in transportation infrastructure, edge analytics on resource-constrained devices, traffic control strategies based on Internet of vehicles architectures, and solutions for cloud services federation and monitoring within the cloud continuum.

By exploring these topics, this special issue aims to provide a comprehensive understanding of the current state-of-the-art research in the application of the cloud continuum in public transportation and mobility. It offers a platform for researchers, practitioners, and policymakers to exchange ideas, share insights, and contribute to the advancement of intelligent transportation systems and sustainable mobility solutions.

2 Content of the special issue

Cartenì, Henke, Errico and Di Bartolomeo authored 'A big data and cloud computing model architecture for a multi-class travel demand estimation through traffic measures: a real case application in Italy'. The aim of the paper is to propose a big data and cloud computing model architecture for a multi-class origin-destination demand estimation based on the application of a bi-level transport algorithm using traffic counts on congested networks, also for proposing sustainable policies at urban scale. The proposed methodology has been applied to a real case study in terms of travel demand estimation within the City of Naples (Italy). The obtained results suggest the usefulness of the proposed methodology in terms of ability in real-time/pre-fixed time periods traffic demand estimation.

Henke, Di Francesco and Errico are the authors of 'Design and cost benefit analysis of an e-mobility service: an electric bus service in Naples, Italy'. This research presents a methodology to design electric bus services in a technically and economically feasible way, taking into account the effects of the new service on users' mobility choice (in terms of modal choice and willingness to pay). This methodology is then applied to a real case study: renewing an 'old' bus fleet with an electric one charged by a photovoltaic system in Naples (Italy). The results of this application show that the strengths of this new technology are flexibility, which has a good match with a constantly evolving transport demand, and cost reduction, which favours greater economic sustainability in the medium and long term.

Botte, Tufano and D'Acierno are the authors of 'A methodology for introducing an energy-efficient component within the rail infrastructure access charges in Italy'. They propose a methodology that integrates cloud-based tasks and simulation tools for defining the rail infrastructure access toll. In particular, the inclusion of the energy consumption of rail operators within the access toll can make the rail system more sustainable. Indeed, numerical applications in the case of an Italian high-speed railway line have shown that the customisation of the toll access charge by considering the required power supply may generate an increase in the energy efficiency of the rail system.

Savitz, Perera and Rana authored 'Edge analytics on resource constrained devices'. This research focuses on performing data analysis and processing at the edge of the network, particularly on devices with limited computing resources. By leveraging edge analytics, researchers aim to overcome the challenges posed by resource-constrained devices and enable real-time decision-making and data processing. This can have applications in various fields, including transportation, where real-time analysis of sensor data can facilitate efficient traffic management, predictive maintenance, and intelligent transportation systems.

Oulha, Di Pace, Ouafi and de Luca wrote 'Traffic control strategies based on internet of vehicles architectures for smart traffic management: centralised vs. decentralised approach'. The paper explores traffic control strategies that leverage internet of vehicles (IoV) architectures for smart traffic management. The researchers compare centralised and decentralised approaches to traffic control, studying the advantages and drawbacks of each. Insights gained can contribute to the development of efficient traffic control systems that use IoV technologies to enhance road safety, optimise traffic flow, and improve overall transportation efficiency.

Alonso, Huarte and Arrieta authored 'ACSmI: a solution to address the challenges of cloud services federation and monitoring towards the cloud continuum'. The topic analysed by this paper focuses on ACSmI as a potential solution for addressing the challenges associated with cloud services federation and monitoring in the context of the cloud continuum'. The research focuses on developing frameworks, protocols, and technologies to facilitate the federation and monitoring of cloud services. Such insights can contribute to the advancement of cloud computing architectures and enable seamless integration and management of cloud-based services in various domains, including transportation.

3 Conclusions

This special issue presents a series of articles addressing fundamental challenges in the cloud edge and cloud continuum domain, considering both general aspects, such as the problem of executing massive computation over resource-limited devices, and specific topics related to traffic management. Urban mobility, smart vehicles, and public transportation represent an important field of application for IoT, cloud and edge computing, and the cloud continuum as they represent a complex use case where researchers can access a consistent amount of data, and at the same time face several challenges. This special issue has covered some of the research topics that are related to these domains, presenting cutting-edge technologies, paradigms and models.

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