A Note on the Convergence of IoT, Edge, and Cloud Computing in Smart Cities

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The purpose of the special issue is to cover all aspects of design and implementation, as well as deployment and evaluation of solutions aimed at the osmotic convergence of IoT, edge, and cloud computing, with specific reference to the smart cities application scenario.

Offering new advanced services to citizens in smart cities requires a huge effort in collecting, storing, and processing data sensed in the environment and produced by the citizens themselves. Cloud solutions can improve the quality of smart city services, offering support to store, analyse, and extract knowledge from the raw data. The increasing need for supporting interaction between IoT and cloud computing systems has also led to the creation of the edge computing model, which aims to provide processing and storage capacity as an extension of available IoT devices without the need to move data or processing to a data center. Thus, we can currently exploit different technologies for smart cities in terms of IoT devices and resources from edge and cloud solutions in order to achieve different goals.

In a new vision of computing for smart environments, edge computing is combined with cloud computing to overcome specific limitations of different computing paradigms and to offer more efficient services. Edge computing can support time-sensitive requirements of IoT applications and exploit the constrained resources of edge devices, while cloud-based programming models can strongly increase computation and storage availability as needed. At the same time, IoT devices are becoming even more powerful and can perform relevant storage and computation tasks on site. Thus, merging IoT, edge, and cloud resources and services can bring unexpected solutions to the future with a high level of responsiveness and complexity.

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Achieving an effective convergence of IoT, edge and cloud computing requires osmotic management of services and microservices across different systems. This means that resources must be dynamically organized and, if necessary, migrated according to the requirements of different infrastructures (e.g., load balancing, reliability, and availability) and applications (e.g., sensing/actuation capabilities, context awareness, proximity, and quality of service [QoS]). Osmotic computing enables microservice and resource orchestration mechanisms, together with the seamless migration of services that adapt their behavior according to resource availability.

IN THIS ISSUE

The purpose of the special issue is to cover all aspects of design and implementation, as well as deployment and evaluation of solutions aimed at the osmotic convergence of IoT, edge, and cloud computing, with specific references to the smart cities application scenario. For this synergy to become effective and efficient, relevant issues related to smart city services and microservices deployment, networking, and security across cloud and edge datacenters must be investigated to provide reliable IoT support within specified QoS levels.

The selected articles in this special issue provide interesting and concrete contributions in this area. They also identify other challenges to be addressed by both the research community and industry to provide efficient solutions for smart cities in the near future.

In “How to Conceive Future Mobility Services in Smart Cities According to the FIWARE Frontier Cities Experience,” Lorenzo Carnevale, Antonio Celesti, Maria Di Pietro, and Antonino Galletta present a cloud architecture design that enables the creation of smart IoT applications. They also validate their approach based on a real-world smart campus testbed.

Puming Wang, Laurence T. Yang, and Jintao Li present another interesting contribution to the smart city paradigm in “An Edge Cloud-Assisted CPSS Framework for Smart City.” Their article discusses a novel edge cloud-assisted, cyber-physical-social system framework that migrates data analysis tasks from cloud data centers to network edge devices, resulting in favorable quality of service (e.g. reduced latency, real-time view of events, etc.).

Finally, in “User-centric Privacy Engineering for the Internet of Things,” Mahmoud Barhamgi, Charith Perera, Chirine Ghedira, and Djamal Benslimane present requirements for future data collection architectures for building CPSS-based smart city applications. Based on this abstract data collection architecture, the authors identify a number of challenges that must be addressed to achieve effective privacy management in future smart city applications.

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