



## EDITORIAL

### Special Issue on Large Scale Cooperative Virtual Environments

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The huge diffusion of distributed networked cooperative applications is due to the recent advances in the area of networking. Several novel applications have emerged in this area: social networks, distributed cryptocurrencies, distributed ledgers, collaborative work and many other ones. In particular, an interesting technology recently adopted to handle cryptocurrencies (such as Bitcoin) is the blockchain technology, that has now taken the more general role to handle several distributed applications. Furthermore, peer to peer, Internet of Things, Smartcities, distributed sensing are examples of modern ICT paradigms that aim to describe globally cooperative infrastructures built upon objects' intelligence and self-configuring capabilities. The definition of these applications requires to afford several challenges, like

the design of user interfaces, coordination protocols, and proper middle-ware and architectures.

The aim of this special issue is to investigate open challenges for such applications, related to both the applications design and to the definition of proper supports. Some important challenges are, for instance, adaptation of the classical blockchain technology to support collaborative applications, protocols design, distributed consensus algorithms, privacy and security issues.

The special issue includes six high-quality papers, two of them are extended versions of the papers accepted and presented at the 5th Workshop on Large Scale Distributed Virtual Environments on Clouds and P2P held in conjunction with EUROPAR 2017, Santiago De Compostela, August 2017. In the following, we give a brief description of each paper.

The paper "A journey into Bitcoin metadata" [1] is a systematic survey on the usage of metadata in Bitcoin, i.e. arbitrary pieces of data which do not affect transfers of bitcoins. The authors search the blockchain for metadata, and parse them to infer the intended usage. They identify 45 distinct protocols which are used by applications to embed metadata in the blockchain, classify them according to their application domain, and measure the amount of metadata they produced. A public dataset of metadata extracted from the blockchain is made available, as well as the tools we have developed for the presented analyses.

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In the paper “Towards the Dynamic Community Discovery in Decentralized Online Social Networks” [2], an analysis of dynamic community detection in Distributed Social Networks is presented by studying a real Facebook dataset. The paper evaluates two different dynamic community discovery classes to understand which of them can be applied to a distributed environment. Results prove that a solution belonging to the Temporal Trade-off class of algorithm is the most promising one.

Carlini et al. in the paper “Analysis of Movement Features in Multiplayer Online Battle Arenas” [3] analyze 912 replay matches of an extremely popular online game, the Multiplayer Online Battle Arenas (MOBA), which roughly correspond to 640 hours of game in a MOBA virtual environment. The authors perform a detailed analysis of the distribution of the AoI population and study the AoI population in terms of stability, i.e. which and how long AoI population values remain constant during a game. Finally, the paper analyzes AoIs in terms of number of friends and enemies in order to detect the different phases of a MOBA game and to detect the number of crowded situations (i.e. battles) in a MOBA game.

Kavalionak et al., in “Distributed video surveillance using smart cameras” [4] propose a distributed algorithm for load balancing between Smart Sensing Units for video surveillance task. The adaptive algorithm distributes, at run time, the recognition tasks between the resources of surveillance devices and servers. The detection and recognition tasks are executed locally by surveillance devices, which exploit both the spatial and temporal topology of the moving people, to cache and reuse locally parts of the classification features. Only when devices are not able to execute the recognition task with the cache, a recognition request is sent to the server. The authors exploit and test different classification algorithms for face recognition: 1-NN and the weighted k-NN classifiers with Local Binary Pattern.

Cai et al. [5] presents “SimSim: A Service Discovery Method Preserving Content Similarity and Spatial

Similarity in P2P Mobile Cloud”, a service discovery scheme for Mobile P2P clouds based on keywords search which preserves content similarity and spatial similarity. A mapping from a keyword set of services to a bit vector with identical hash is designed to preserve content similarity.

The last paper, “End-to-end voting with Non-permissioned and Permissioned Ledgers” [6], presents a decentralised end-to-end voting platform based on the blockchain technology which directly casts a vote to the blockchain, without any intermediate level. The paper shows two implementation exploiting, respectively, the non-permissioned ledger of Bitcoin, and the MultiChain permissioned ledger. A comparison of the two solutions is presented.

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## References

1. Bartoletti, M., Bellomy, B., Pompianu, L.: A journey into Bitcoin metadata
2. Guidi, B., Michienzi, A., Rossetti, G.: Towards the dynamic community discovery in decentralized online social networks
3. Carlini, E., Lulli, A.: Analysis of movement features in multiplayer online battle arenas
4. Kavalionak, H., Gennaro, C., Amato, G., Vairo, C., Perciante, C., Meghini, C., Falchi, F.: Distributed video surveillance using smart cameras
5. Cai, Z., Lee, I., Chu, S.-C., Huang, X.: SimSim: A service discovery method preserving content similarity and spatial similarity in P2P mobile cloud
6. Bistarelli, S., Mercanti, I., Santancini, P., Santini, F.: End-to-end voting with Non-permissioned and Permissioned ledger