

AoI-Aware Query Services in Digital-Twin Empowered Edge Computing

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Abstract—The Mobile Edge Computing (MEC) paradigm gives impetus to the vigorous advancement of the Internet of Things (IoT), through provisioning low-latency computing services at the edge of core networks. The emerging digital twin technique has grown in the IoT community, and bridges the gap between physical objects and their digital representations in MEC networks, thereby enabling real-time data analysis, simulating the dynamics of systems, predicting the behaviours of objects, and optimizing decision-making. In this talk, we consider AoI-aware query services in an MEC network empowered by the digital twin technology for diverse IoT applications, with the aim to jointly optimize the freshness of query results that are measured by the Age of Information (AoI), and service response delays. We focus on two query service problems: The first one is to minimize the weighted sum of the accumulative freshness of query results and the total delay of query services, for which we devise an approximation algorithm with a provable approximation ratio, by exploring non-trivial trades-off between the two conflicting optimization objectives. The second one is to maximize user service satisfaction measured by a non-decreasing submodular function that aims to improve the freshness of query results by multiple digital twins' placements for each object. We formulate two optimization problems under static and dynamic query arrival settings, for which we develop performance-guaranteed approximation and online algorithms for them. We finally evaluate the performance of the proposed algorithms via simulations. The simulation results demonstrate that the proposed algorithms are promising, outperforming their comparison benchmarks.

300 papers so far, and his work has been cited nearly 9,600 by Google Scholar with index 53. His research is funded by Hong Kong Research Grants Council and Australian Research Council (ARC). He currently serves as an Editor for IEEE Transactions on Communications, and for Pervasive and Mobile Computing Journal, Elsevier, respectively.

BIO

Weifa Liang received the PhD degree from the Australian National University in 1998, the ME degree from the University of Science and Technology of China in 1989, and the BSc degree from Wuhan University, China in 1984, all in Computer Science. He is a professor in the Department of Computer Science at City University of Hong Kong (CityUHK). Prior to joining CityUHK, he was a professor in the Australian National University and worked there for over 20 years. His research interests include wireless ad hoc and sensor networks, Mobile Edge Computing (MEC), Network Function Virtualization (NFV), digital twins and Internet of Things, approximation and online algorithm design, and graph theory. He has been actively publishing high quality papers in the prestigious venues including top journals (e.g., TON, TMC, TPDS, TC, TKDE, JVLDB, JSAC, TCOM, TWC, JPDC, TCS) and conferences (e.g., INFOCOM, ICDCS, IPDPS, IWQoS, WWW, ICPP, PerCom). He has co-authored nearly