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Technology Challenges and Research Opportunities in Database Systems

Abstract: Database Systems have existed for six decades and have had significant impact on how private and public organizations manage their data in the context of industrial, societal, and scientific activities. The relational model and the SQL language are the global standards for accessing databases and have served as the foundations for advancing the field through the years, creating a multi-billion industry around the world. With the current advances in several other technological areas, notably, new general and specialized hardware, high-performance and high-throughput (cloud) computing, and machine learning / AI / LLMs, database technology is in front of yet another revolution of its own, addressing numerous new challenges, pointing to new directions for industrial advances, and opening new opportunities for exciting research. In this presentation, I will give a quick tour of the status of database systems and then elaborate on some relevant research and technological challenges that could possibly lead to the next breakthroughs in the field. Particular attention will be given to applications (e.g., data science, data analytics, and edge computing), where User-Defined Functions (UDFs) are used within relational database queries in SQL. In such contexts, I will give some highlights of YeSQL, a language and system developed with colleagues and members of my team, which is effectively addressing the impedance mismatch that exists between UDF evaluation and relational operator processing, achieving significant speedups in common, practical use cases compared to earlier approaches and alternative implementation choices.



Bio: Yannis Ioannidis is the President of the Association of Computing Machinery (ACM). He is a Professor at the Department of Informatics and Telecom of the University of Athens as well as an Associated Faculty at the “Athena” Research and Innovation Center, where he also served as the President and General Director for 10 years. Before returning to Greece, he was also on the Computer Science faculty of the University of Wisconsin – Madison. His research interests include Database and Information Systems, Data Science, Data Infrastructures and Digital Repositories, Recommender Systems and Personalization, and Interactive Digital Storytelling, topics on which he has published many articles in leading journals and conferences and holds four patents. His work is often inspired by and applied to data management and analysis problems that arise in industrial environments or in the context of other scientific fields (Social Sciences and Humanities, Life Sciences, Physical Sciences) and the Arts. He is an ACM and IEEE Fellow, a member of Academia Europaea, and a recipient of several research, teaching, and service awards. He is a co-founder of OpenAIRE, the international data infrastructure for Open Science in Europe, as well as of several AI/data-driven spin-offs. He is also a co-chair of the Global Climate Hub of the UN Sustainable Development Solutions Network.