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Edge processing and the Internet of Things; edge processing and the Internet

The Internet of Things (IoT) will lead to various serious problems, two of which will be addressed: The enormous data volumes and the security problems. We will first identify the problems in three sample scenarios, namely: Management of charging stations for electrified cars, storing patient documentations securely and traffic management in smart cities. When only 50,000 devices in a city deliver 500 bytes of data per second, we have more than 2 terabyte of data per day. It is obvious that classical communication and database technology can hardly cope with the data volume and the data rates. We will then present an innovative, perfectly scaling architecture for storing and analyzing such huge data volumes. This architecture stores data in edge databases (on or near) the devices and integrates them into a hierarchy of virtual distributed databases reflecting e.g., buildings, cities, countries, continents and finally the entire globe. Data is stored efficiently and most scalably in the edge databases, data analysis queries are provided on all affected hierarchy levels. Those queries are sent and processed to all subordinate databases in parallel and their results are aggregated subsequently into a single result. This approach is heavily based on an IoT database system such as Transbase which runs on all hierarchy levels starting from Raspberry Pi based devices over smartphones upto large servers. As data is stored on the devices, also their privacy can be controlled by local policies based on SQL privileges for outside access. Stronger security requirements for cloud storage are covered by an integrated encryption platform that is based on end-to-end encryption. The key management as well as identity management is delegated to a central database. The key features of this approach are: Private keys are stored in the device only, they are never transferred into the database or to other devices, each document is encrypted by a specific random key which is stored nowhere. Instead the key is encrypted for all the owner's device keys and all entitled users separately, the documents itself can be stored somewhere in the cloud, application layers on end-user devices have access to the user's private key and are able to decrypt documents and, document meta data is stored and synchronized between devices automatically.

Biography

Rudolf Bayer is an emeritus Professor of Informatics at Technical University of Munich where he had been employed since 1972. He is noted for inventing three data sorting structures: the B-tree (with Edward M McCreight), the UB-tree (with Volker Markl) and the red-black tree. He is a recipient of 2001 ACM SIGMOD Edgar F Codd Innovations Award. In 2005, he was elected as a fellow of the Gesellschaft für Informatik.

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