



ZEN AND THE ART OF EMBEDDABLE DATA

Multiplatform, embeddable database for self-managed,
small-footprint environments

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EXECUTIVE SUMMARY

Action Zen is a multiplatform, embeddable database for self-managed, small-footprint environments that was developed over more than a decade from a group of technologies created and acquired by Actian, a Silicon Valley-based maker of data management, analytics, and integration products. It was rebranded in 2017 to underscore its essential relationship with developers facing the unique challenges of creating applications for the Internet of Things (IoT) and Edge Computing.

This is a solution for a new ecosystem, but one with deep roots in technologies that have been around for more than 30 years. Because of those roots, Actian Zen is unique among embeddable database solutions in several ways. This white paper looks at the origins of this product, the capabilities it currently provides, and the environment into which it has emerged.



DEFINITIONS

Almost inevitably, some confusion arises when the discussion turns to edge of the network, and it's worth taking a moment to define a few terms.

Embedded

The terms embedded database and embeddable database refer to a database and/or a management system (DBMS) that is integrated into, or very tightly with, the application that needs

direct or fast access to the data it contains. The DBMS is therefore dedicated to the app using it.

It's important to remember that an embedded database can be an in-memory database, reside on solid state or traditional disk storage, or be some combination of both.

Also, an embedded database is a critical part of an intelligent embedded system, where special-purpose software with a dedicated function is installed on a piece of hardware.

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IoT

The Internet of Things is part of the popular lexicon now, but just to be clear, IoT refers to the vast and ever-expanding network of physical devices linked through the Intranet or Internet. There are billions of them now, everything from smart phones to temperature sensors, appliances to cars. The software installed on them gathers, stores, and analyzes data, either locally or through a connection with separate compute platforms and associated databases.

has also been described as a decentralized data persistence that occurs on or near the devices that generate the data.

Fog Computing, a term coined by Cisco Systems in 2014, effectively means the same thing as Edge Computing, though it's more directly associated with Cloud Computing and has a Cloud-side view of where in the Edge intelligence will reside. As Cisco defines it, the Fog "extends the cloud to be closer to the things that produce and act on IoT

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One subcategory worth keeping in mind is the IoT gateway (sometimes called an intelligent gateway or a control tier). It can take the form of a physical hardware appliance or a piece of dedicated software. It serves as the connection between the cloud and the universe of controllers, sensors, and/or intelligent devices.

Edge Computing

Edge Computing refers to a distributed information architecture in which the processing of data occurs where it is generated, far from a centralized data-center, at the "edge" of the network. That processing is done on IoT devices and remote gateways. Edge Computing

data." The term has been called a marketing take on Edge, but it has been catching on. ("Fogging" has even become a verb.)

To be clear, Fog Computing pushes intelligence down to the local area network (LAN) level of the network architecture, and the data is processed through a "fog node" or IoT gateway; Edge Computing pushes the intelligence, processing power, and communication capabilities of an edge gateway or appliance directly into devices. More than likely, there will be an ebb and flow of intelligence between gateways and devices such that the distinction between Fog and Edge terms are largely semantics.

IOT AND COMPUTING AT THE EDGE OF THE NETWORK

Small-footprint embeddable databases are not new, of course. During the 1990s and early 2000s, embedded DBMSs were used to manage data flows over wired networks for a range of media-intensive applications. But today, virtually all transactions among IoT devices, media-intensive and otherwise, require this level of data access.

It could be argued that the primary advantage of an embedded DBMS is reduced network latency and faster application performance. If the application and the data it needs to access reside on separate machines, the app will be slow; if they're tightly integrated, the app will be fast. Speed matters, especially when it comes to IoT devices. Lagging response times from fitness bands and smart thermostats are annoyances among users of those products, but it's downright dangerous in autonomous vehicles and medical devices.

But fast data access isn't the only advantage of an embedded database. An embedded DB comes with a small footprint, which is critical in resource constrained environments. Also, it's distributed with the application, so there's no need for the end user to install it separately—in fact, the database is invisible to the end user. And because it's linked directly to the application as an in-process software library, it requires almost no database administration. Finally, because the database is dedicated to the application, there is less chance of security vulnerabilities being

introduced by other applications, as would be the case with a communal database typically used in enterprise data warehouses, data lakes and other multi-purpose environments.

THE ROOTS OF ZEN

Action was the original commercial supporter of Ingres, an open-source, SQL relational DBMS developed in the 1980s at the University of California, Berkeley, for large commercial and government applications. (There's still an active Ingres user/developer community that Action supports.) In the early 2000s, the company shifted its focus to the emerging opportunities and challenges of the Big Data phenomenon, and then to IoT and Edge Computing. The list of its acquisitions over the past decade includes ParAccel, a provider of a DBMS for Big Data analytics; VectorWise, an Ingres-based SQL relational DBMS aimed at analytical database applications; and Pervasive Software, a vendor of cloud-based and on-premises software for data management and analysis and creator of the DBMS known as PSQL.

PSQL is optimized for embedding in applications, and it is the core of Action Zen. Its architecture comprises a transactional database engine and a relational database engine, both of which can access the same data, but through different methods. The transactional engine, known as the MicroKernel Database Engine (MKDE), interacts directly with the data and does not require fixed data schema to access it. The relational component, known as

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the SQL Relational Database Engine (SRDE), is a relational DB accessed via Structured Query Language (SQL) queries. Those queries are parsed and sent to the MKDE to run.

Early versions of the product were called Btrieve and then Pervasive PSQL, and the company still provides support for products purchased under the Pervasive name. With Zen, the company has extended the essential features of the embedded editions of “classic PSQL” to a new generation of intelligent apps in the Cloud and pared down to support smart devices at the Edge. The new name is actually an acronym meant to reflect the product’s key features for IoT and Edge Computing: Zero-DBA, Embeddable, and Nano-footprint.

“Zen” is now the rubric for a product family that includes several editions of the embeddable database: Zen Edge Server for IoT; Zen Enterprise Server for Windows, Linux, and Mac OS; Zen Core for Android and iOS (Zen Core can be adapted to virtually any device running a POSIX compliant variant of Linux); Zen Workgroup for Windows Server; and the Zen Cloud Server (on VMware vSphere, Microsoft Hyper-V, and Citrix XenServer). The company markets these products to

system integrators (SIs), independent software vendors (ISVs), original equipment manufacturers (OEMs), and enterprise customers building in-house applications that require an embedded DBMS.

ZEN AT THE EDGE

Zen has emerged at the edge of the network as a focused group of embeddable database management solutions with an impressive range of capabilities that should make life easier for developers facing the vicissitudes of an evolving mobile application front end and IoT ecosystem.

Common data type

One clear breakthrough feature is Zen’s ability to deliver a common data type and file format across all platforms, as the company puts it, “from the edge to the gateway to the enterprise.” This capability eliminates the typical ETL overhead involved when moving data among operating environments or versions of the database. Data moved from, say, an ARM device (such as a Raspberry Pi) to a Linux server or virtual machine in a Public or Private Cloud requires no ETL. Again, as the company puts it, “just copy the data and go.”

