

Telecom/Network Infrastructure

An embedded database delivers fault-tolerance, real-time performance and significant manufacturer cost savings.

“Our evaluation determined that eXtremeDB outperforms other in-memory database systems, meeting our current needs and, just as importantly, accommodating future growth.”

—Transaction Network Services, Inc.

eXtremeDB, the real-time embedded database for devices that are eXtremely innovative

Overview

Modern voice and data transmission depend on a chain of computing tasks executing almost simultaneously, with the entire system always available. At the same time, equipment at seemingly every network node is adding features that must retrieve, sort and store complex data. Rules engine, network fault management, roaming service, fraud/threat detection, chassis management and revenue assurance – these are just a few of the emerging telecom and network communications infrastructure applications in which data management plays a critical role. How can developers meet this need reliably, without giving up system speed and availability?

The eXtremeDB[®] In-Memory Database System (IMDS) from McObject[®] delivers a powerful and popular solution. eXtremeDB IMDS stores and works with data entirely in main memory, eliminating disk and file I/O, cache management, data transfer and other types of performance overhead that are hard-wired into traditional “on-disk” DBMSs. As a result, typical eXtremeDB read and write accesses are at the level of a few microseconds, or less.

In addition, the engine is re-entrant, allowing for multiple execution threads, with transactions supporting the ACID (Atomic, Consistent, Isolated and Durable) properties for data integrity. And eXtremeDB’s streamlined design results in an ultra-small footprint (approximately 150K code size) and highly efficient use of CPU cycles.

Building on the core IMDS product, McObject offers specialized eXtremeDB editions with capabilities including hybrid in-memory and on-disk storage (eXtremeDB Fusion), 64-bit support (eXtremeDB-64) and the ability to deploy within the OS kernel (eXtremeDB Kernel Mode).

High Availability & Clustering

Two eXtremeDB editions with special applicability to telecom and networking equipment are eXtremeDB High Availability (HA) and eXtremeDB Cluster. eXtremeDB-HA enables deployment of one “master” and one or more synchronized “replica” databases within separate hardware instances, with automatic failover. Supported replication strategies include 2-safe (synchronous) and 1-safe (asynchronous). The HA edition delivers true ‘five nines’ (99.999% uptime) reliability, or better, with eXtremeDB’s unsurpassed performance and tiny



F5 Networks deploys eXtremeDB IMDS across its BIG-IP product family

footprint.

In distributed architectures based on eXtremeDB Cluster, every database instance serves as a master. Any process on any node can update its local database, and Cluster efficiently replicates changes to other nodes. This eliminates the potential bottleneck of writing many changes to a single master. Benefits include dramatically increased available net processing power, lower system expansion costs (by enabling use of low-cost “commodity” hardware), and maximum scalability and reliability for the most data-intensive applications.

Efficient Development, Cost Savings

Manufacturers benefit, in tangible ways, from eXtremeDB’s development ease. The product’s native C/C++ API is intuitive to use and leads to easily maintainable code (native Java and C# APIs, as well as an SQL interface, are also available). The product’s sophisticated debugging and type-safe API dramatically reduce potentially expensive run-time bugs, while its support for virtually all data types and querying methods maximize developer flexibility.

Many telecom/netcom applications still rely on “homegrown” data management. But upgrading from proprietary, internally developed code to the proven eXtremeDB database system eliminates development, debugging and QA cycles, slashing time-to-market. And because eXtremeDB is easily extended with new indexes and tables, and naturally separates application logic from database logic, applications based on it are considerably easier to upgrade and maintain.

***eXtremeDB* IMDS Features & Benefits**

Streamlined architecture – McObject built *eXtremeDB* from scratch for in-memory data storage and manipulation, delivered via the shortest possible execution path. Get maximum speed and efficiency without application rewrites or expensive new hardware.

Industry-tested solution – Motorola, Hutchison, F5 Networks, Spirent Communications, Airspan Networks, Nokia Siemens Networks, Transaction Network Services and other industry notables have opted to embed McObject's *eXtremeDB* database system in their telecom and network communications equipment.

Hybrid data management – *eXtremeDB* Fusion enables the developer to designate persistent storage for selected record types, to optimize the database for durability, speed, storage cost and form factor.

Developer efficiency – *eXtremeDB*'s support for multiple data index types (including the telecom-specific Patricia Trie), diverse APIs (C/C++, SQL, Java and C#), advanced debugging capabilities and intuitive, type-safe API boosts developer productivity, for shorter time-to-market and better, safer code.

Concurrent access – in-memory databases can be created in local or shared memory. With *eXtremeDB* Fusion, multiple processes and threads share the on-disk database cache. A remote interface provides network access.

Highly Scalable – the 64-bit *eXtremeDB* edition is proven managing a RAM-based database exceeding 1 terabyte and 15 billion rows, delivering more than 87 million query transactions per second (benchmark report is available). An optional multi-version concurrency control (MVCC) transaction manager is optimized for multi-threaded applications running on multi-core CPUs.

Open Replication – McObject's *eXtremeDB* Data Relay technology facilitates highly efficient, fine-grained data sharing between real-time systems based on *eXtremeDB*, and external systems such as enterprise DBMSs.

Application areas:

Rules engine, roaming service, network device/element database, AAA (authentication, authorization, accounting), fraud and threat detection, call management, eNodeB support, equipment monitoring, configuration data management, traffic analysis, routing table management, network interconnect management, phone contact database, shortcuts list, ENUM registry, chassis management, test equipment/protocol analyzers, billing/revenue assurance, event and alarm response.

Technical Specs

- Code size from 150K to 300K, depending on platform and *eXtremeDB* features used.
- Multi-platform support. Highly portable, with source code available. Can run without an operating system in "bare bones board" configurations.
- Transaction performance measured in microseconds.
- In-memory and on-disk storage co-exist within *eXtremeDB* Fusion database instances, via simple database schema declarations.
- Implements Patricia Trie index for efficient management of IP address and routing data. Other querying methods include B-Tree, R-Tree, KD-Tree, hash table and custom indexes.
- C/C++, Java, C# and SQL interfaces; supports varied data types and sophisticated debugging features.
- With *eXtremeDB* Fusion's Cache Prioritization, applications can influence how long certain pages remain in cache, to minimize retrieval overhead for data used in time-sensitive tasks.
- Event Notifications enable *eXtremeDB* to inform an application when something "of interest" in the database changes. (Available in synchronous and asynchronous modes.)
- Security features include page-level Cyclic Redundancy Check (CRC) to detect unauthorized modification to data, and RC4 encryption to prevent access or tampering.



Airspan Networks' Air4G LTE/WiMAX wireless broadband network base stations rely on *eXtremeDB*.