

eXtremeDB™ Standard Edition

High performance, small footprint in-memory database system (IMDS) for embedded devices.

“eXtremeDB gave us the performance and flexibility we required to manage the complex data in our applications.”

-- Genesis Microchip

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

Overview

eXtremeDB Standard Edition is McObject's core product. It is designed for performance, with a strict memory-based architecture. Data is stored and manipulated exactly in the form used by the application, removing overheads of caching and translation. Typical read and write accesses are at the level of a few microseconds, or less. The engine is reentrant, allowing for multiple execution threads, with transactions supporting the ACID properties and data integrity.

The Runtime Environment

Accelerated transactions. *eXtremeDB* slashes latency by storing data in main memory, eliminating the need for disk access, caching and other overhead of disk-based DBMSs. Its transaction manager is optimized for ultra-fast processing.

Tiny footprint. A streamlined design delivers the maximum in performance and features with a code size of **approximately 100K!** This makes it a powerful enhancement to intelligent devices with resource limits that, until now, ruled out the use of a database system.

Direct data access. By working with data directly in main memory, *eXtremeDB* eliminates the overhead of data duplication and transfer inherent in disk-based DBMSs. Databases can be created in shared memory, enabling concurrent access by multiple processes.

Highly Scalable. Some real-time systems manage large data stores. The 64-bit *eXtremeDB* edition is proven in terabyte-plus deployments. Advanced memory management, and a Multi-Version Concurrency Control (MVCC) transaction manager, fully leverage multi-threading on multi-core systems.

No Translation. *eXtremeDB* stores data in the form used by the application. This eliminates translation tasks, such as mapping a C data element to a relational representation.

High reliability. For data integrity, *eXtremeDB* transactions support the ACID properties, ensuring that operations grouped into transactions will complete together or the database will be rolled back to the pre-transaction state.

The Development Environment

Developers strive to produce readable, maintainable, efficient code in the shortest possible time. *eXtremeDB* includes several features that boost the developer's capabilities when integrating *eXtremeDB* in demanding real-time applications.

Incorporating third party software often means learning and adopting an API that does not completely fit an application. ***eXtremeDB's* native, project-specific API** for development in C/C++ ensures that each database operation in the API reflects the type of data being manipulated. Optional *eXtremeSQL* supports the widely used SQL standard, and a Java Native Interfact (JNI) delivers the ease of working with “plain old Java objects” (POJOs).

McObject offers full source code, to give an in-depth understanding of *eXtremeDB* within an application.

***eXtremeDB* supports complex data types** including structures, arrays, vectors and BLOBs.

***eXtremeDB* provides extremely efficient indexing for queries.** Rather than storing duplicate data, indexes contain only a reference to data, keeping memory requirements to an absolute minimum. Supported indexes include:

- Hash indexes for exact match searches
- Tree indexes for pattern match, range retrieval and sorting
- R-tree indexes for geospatial searches
- KD-tree for spatial and Query-By-Example (QBE)
- Patricia trie indexes for network, telecom
- Object-identifier references, for direct access
- Custom indexes

For application debugging, the *eXtremeDB* runtime includes **progressive error detection and consistency features.**

For development, the *eXtremeDB* runtime implements many verification traps and consistency checks. Obviously, that requires CPU cycles and memory. Then, when the application is debugged and consistently passes verification tests, developers can employ the optimized *eXtremeDB* runtime with fewer checks, to restore valuable clock cycles.

Additional Features

eXtremeDB's many extras help developers and application end-users get the most from the database.

- **HTML database browser/editor.** Retrieve database and class statistics and lists of classes; generate schema in the form of a Data Definition Language (DDL) file
- **XML Extensions.** Generates interfaces to create or update an object in the database from the content of an XML document, export an object as an XML document, and to generate an XML schema
- **Remote procedure call mechanism (MCORPC).** Framework enables remote processes to read/update an *eXtremeDB* in-memory or persistent database
- **Database calculator.** Collect information needed to choose ideal page size and to optimize schema designs, storage layout and performance
- **Pattern search.** Use wildcards to search tree index entries for single and multiple character matches

Supported Platforms

Embedded Platforms:

- VxWorks 5.5, 6.x
- VxWorks 653 RTOS (for avionics)
- INTEGRITY OS
- QNX 6.x
- Various Real-Time Linux distributions
- Lynx OS
- RTX C Quadros, RTX C 3.2
- Microsoft Windows Embedded
- eCos
- Nucleus
- Bare bones boards (no operating system required)

Development environments

- gnu toolchain (gcc 2.95 and higher)
- Tornado 2.0 and 2.2 (GNU and Diab compilers)
- QNX Momentics IDE (C, C++, Embedded C++)
- Metrowerks CodeWarrior IDE (various platforms)
- GreenHills Multi
- Microsoft Visual Studio (C/C++, .NET)

Server and Desktop Platforms:

- Sun Solaris 8, 9 and 10
- HP-UX 11.x
- Linux distributions
- Classic Windows platforms (98/NT/2000/XP/Vista)

Database Specifications

Maximum database size, 32-bit:	3 gigabytes
Maximum database size, 64-bit:	18 exabytes
Maximum classes per database:	32,767
Maximum indexes per database:	32,767
Maximum fields per class:	32,767
Maximum fields per index:	32,767
Maximum elements per vector:	32,767
Memory requirements:	As little as 60K
Maximum simultaneous connections per database:	configurable
Maximum databases open simultaneously:	configurable

Supported Data types

- 1, 2, 4, 8-byte signed/unsigned integers
- float, double
- date, time
- char (fixed length)
- string (variable length)
- rect(angle)
- Unicode
- boolean (array of bits)
- enum
- fixed-size array
- variable-length vector
- structs (embedded to any depth)
- autoid (auto-increment)
- user-defined object-id and references

The *eXtremeDB* Product Family

Building on the core Standard Edition IMDS, McObject offers *eXtremeDB* editions to meet specialized needs.

- ***eXtremeDB* High Availability** for the highest level of database fault-tolerance
- ***eXtremeDB-64*** – 64-bit edition accelerates processing of very large databases
- ***eXtremeDB* Fusion** combines in-memory and persistent storage in a single hybrid database
- ***eXtremeDB* Transaction Logging** provides recovery capabilities via a highly configurable logging process
- ***eXtremeDB* Kernel Mode** deploys in OS kernel space, leveraging the kernel's performance and determinism