

## Enea Polyhedra®: Lightweight Database Management Optimized for Embedded Systems

Polyhedra is a family of compact, lightweight, SQL relational database management systems (RDBMS) optimized for embedded systems applications. Built on an ironclad client-server architecture, Polyhedra IMDB (in-memory database) and Polyhedra Flash DBMS provide a secure data repository for embedded systems, mobile devices and server-based applications demanding the utmost in performance and reliability.

### Key Benefits

- ▶ Memory resident – Real-time performance
- ▶ Standards based: SQL, ODBC, JDBC and ADO.NET
- ▶ Continuous availability through Fault Tolerant support
- ▶ Active queries avoid the need for polling
- ▶ Database triggers to maintain database integrity
- ▶ Optimistic and pessimistic locking
- ▶ Historian module to capture time-series data
- ▶ Heterogeneous client-server architecture
- ▶ Fully transactional and ACID compliant
- ▶ Data replication and subscription
- ▶ Interface to PLCs, RTUs
- ▶ SSL module allow encrypted connections
- ▶ Multi-platform with cross-platform support

Polyhedra is used at the core of many of the worlds most advanced and important data-intensive wireless, IP network infrastructure, and industrial control systems. Enea Polyhedra’s memory-resident design and active technology can boost performance by orders of magnitude compared to traditional disk-based RDBMSs. Polyhedra also provides high-availability features such as transaction journaling, hot standby support, dynamic schema update and inter-version compatibility that make it the RDBMS of choice for equipment makers and service providers who require ‘5 nines’ or better uptime. Polyhedra IMDB is available for both 32-bit and 64-bit platforms.

### In-memory performance

High performance and low latency are critical characteristics for real-time systems. Enea Polyhedra’s memory resident, event driven design enables it to deliver ACID compliant, millisecond-level performance (or better) and service requests that would otherwise be unworkable in a real-time environment. Polyhedra’s active query mechanism further enhances performance by notifying client applications whenever relevant data changes occur, avoiding the need for polling.

### Continuous availability, fault tolerant

The database systems used in next generation wireless and broadband network infrastructure equipment require a high level of availability. Polyhedra enhances availability by reducing susceptibility to single points of failure, providing fault-tolerant mechanisms that

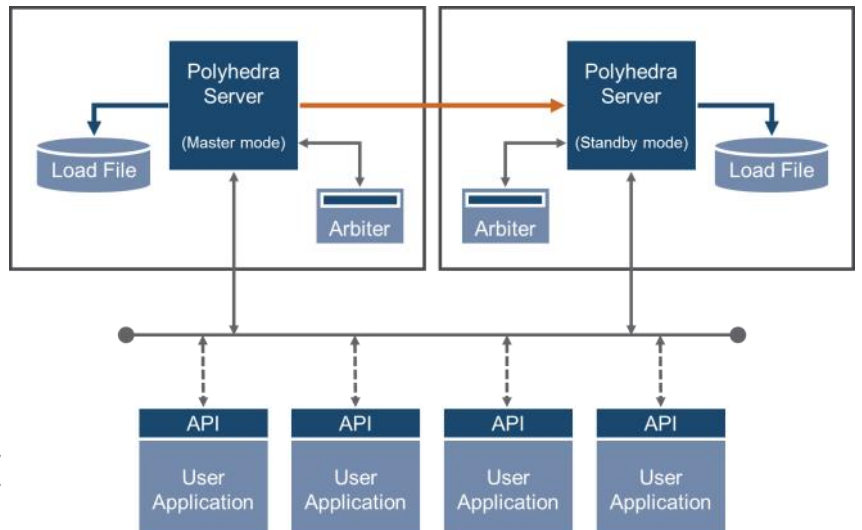


Figure 1. The Polyhedra database management system in a fault tolerant configuration.

ensure continuous client operation and transaction integrity.

Polyhedra uses a hot-standby mechanism to maximize availability. The standby database is continually fed changes from the master database. This enables the standby to take over immediately when it receives notification of a failure of the master. In addition, the client libraries can automatically switch over to the new master when they lose touch with the old master. Very little application code is required to take advantage of these high-availability features.

Figure 1 shows a typical fault-tolerant configuration. When a failover occurs, user applications automatically reconnect from one server to another in a seamless fashion, without the need for special coding in the application. A journal logging mechanism ensures that critical data survives major failures (such as power outage) that require a full restart of the entire system. Replica servers may also be configured, allowing the off-loading of frequent or complex queries to other machines.

### **Distributed, scalable client-server architecture**

Polyhedra's client-server architecture enhances data integrity and resilience by separating data from the applications that use it, thereby protecting the memory used by the database software from accidental modification. Enea Polyhedra's heterogeneous client-server architecture also enhances flexibility, enabling distributed applications to seamlessly access Polyhedra databases residing on any combination of hardware platforms. This flexibility enables Polyhedra database implementations to scale linearly, from a single node to large clusters and networks. The ability to remotely access the database also simplifies system development and testing, even when the system is intended for standalone use.

### **Active technologies boost performance and simplify development**

Polyhedra's active queries boost performance by monitoring data for changes. When a data change occurs, the server automatically transmits a "delta" message to the client. This automatic notification eliminates the need for clients to poll the server or re-issue queries to determine what has changed.

Polyhedra provides another active technology that allow programmers to associate "behavior" with data, i.e. a behavior that can be triggered by changes of the data. The database trigger simplifies the development of client

applications and enhances robustness by the set-up of active, triggered, database-resident code, which enables application-level data integrity rules to be built into the database. Embedding "business logic" in this way improves the overall "correctness" of the information in the database. It also simplifies application development by centralizing consistency checks and enabling the database to handle changes without the need for external application code.

### **Faster development, standard client APIs**

- Polyhedra's portability and cross platform support greatly enhance flexibility during development and testing. Polyhedra also simplifies application design by offering standard APIs that make it easy to interface client applications with Polyhedra databases.
- For C/C++ developers, Polyhedra provides an ODBC-compliant API with extensions for event-driven programs using active queries, as well as a proprietary API that uses a callback model. Polyhedra provides a native ODBC support library for each supported platform. The library does not require an ODBC driver manager.
- For Java developers, Polyhedra provides a pure Java (type 4) portable JDBC driver, which supports all the features of Polyhedra, including active queries.
- For developers on Windows platforms. Polyhedra provides an ADO.NET data provider which simplifies the usage of Polyhedra databases and the that takes full advantage of all Polyhedra features. The ADO.NET data provider is available in 32-bit and 64-bit versions.
- For Python developers, Polyhedra provides a specific Python binding to utilize Polyhedra databases and features.

More information about Polyhedra is available at:

[www.enea.com/polyhedra](http://www.enea.com/polyhedra)



Enea develops the software foundation for the connected society with a special emphasis on reducing cost and complexity at the network edge. We supply open-source based NFVI software platforms, embedded DPI software, Linux and Real-Time Operating Systems, and professional services. Solution vendors, Systems Integrators, and Service Providers use Enea to create new networking products and services faster, better and at a lower cost. More than 3 billion people around the globe already rely on Enea technologies in their daily lives. For more information: [www.enea.com](http://www.enea.com)