RAIMA

Raima Company Whitepaper

Enabling edge applications to move data to the cloud

- Provider of High Performance In Memory Database Technology
- Small footprint, cross platform
- database with both In-Memory and persistent storage device functionality
- Optimized for flash & SSD by minimal writes to the medium for longer lifespan
- Well field tested.

Raima is a leading provider of OLTP high-performance, real-time database management systems for both in-memory and persistent storage for Edge and IOT devices.

Raima´s focus is high speed database solutions which are cross- platform, small footprint designed for distributed architecture in resource-constrained environments.

Raima Database Manager (RDM) is made to Collect, Store, Manage and Move data securily from the devices on the edge to the Cloud. Our Raima Database Manager (RDM) product is optimized to allow flash and SSD devices to live longer through less writes to the medium.

RDM offers a tested and well proven reliable ACID compliant database technology and employs a number of advanced solutions to meet today's complex edge data management challenges such as storing and moving data in a timely fashion from a small low-powered IoT/IIoT embedded device up into larger cloud-based enterprise systems .

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Raima in Brief

Mission Statement: Develop once, deploy anywhere

Raima's mission is to provide seamless dataflow in a Big Data, Internet of Things and a M2M environment. This will enable our clients to collect, store, manage and move information fast, safe, secured and seamless. Raima will facilitate the use and flow of meaningful, valuable data in a system composed of all forms of computing processes and equipment and be an essential ecosystem participant in the process of creating value out of data.

Raima supporting edge computing

Edge computing is a distributed information technology architecture in which client data is processed at the periphery of the network, as close to the originating source as possible. The move toward edge computing is driven by mobile computing, the decreasing cost of computer components and the sheer number of networked devices in the IOT world. Depending on the implementation, time-sensitive data in an edge computing architecture may be processed at the point of origin by an intelligent device or sent to an intermediary Raima server located in close geographical proximity to the client. Data that is less time sensitive is sent to the cloud for historical analysis, big data analytics and long-term storage.

Transmitting massive amounts of raw data over a network puts tremendous load on network resources. In some cases, it is much more efficient to process data near its source and send only the data that has value over the network to a remote data center. Instead of continually broadcasting data about the oil level in a caŕ s engine, for example, an automotive sensor might simply send a summary of data to a remote server periodically. Or, a smart thermostat might only transmit data if the temperature rises or falls outside acceptable limits. Or, an intelligent Wi- Fi security camera aimed at an elevator door might use edge analytics and only transmit data when a certain percentage of pixels significantly changes between two consecutive images, indicating motion.

Edge computing can also benefit remote office/branch office environments and organizations that have a geographically-dispersed user base. In such a scenario, intermediary microdata centers or high-performance Raima servers can be installed at remote locations to replicate cloud services locally, improving performance and the ability for a device to act upon perishable data in fractions of a second.

A major benefit of Raima´s edge computing is that it improves time to action and reduces response time down to milliseconds, while also conserving network resources. The Raima concept of edge computing is not expected to replace cloud computing. Despite Raima´s ability to reduce latency and network bottlenecks, edge computing can pose significant security risks that Raima is well-positioned to address.

While a solid and complete IOT to Cloud solution can address issues related to security, cognition, agility, latency and efficiency Raima plays an important role in providing the data management directly on the edge embedded devices. Raimá s compact linkable database library can enable users to gather data in virtual real time, nearest the data generating source, and allows for summarization of that data so that critical actions and decisions can be made much sooner. Raimá s database on the IOT edge helps safeguard against latency issues that come into play if these applications have to wait for data to be directly moved to a central control center where a decision is not made in time.

As another example, an autonomous vehicle system. A smart car may in the future generate terabytes of data per trip while connecting and communicating in motion with traffic control or other vehicles. In such environment latency is measured in sub-milliseconds. It is not possible to deal with network availability issues and bandwidth is crucial. RDM plays an important role in solving such latency issues by being embedded out on the edge of such an application.

Another example is a smart building. Smart building applications are starting to leverage industrial internet for improved business outcomes. When coupled with the Raima database on the edge IoT embedded devices located throughout such an application, Raima can provide near real-time local processing and storage to optimize and save costs.

There are several examples, but regardless, the same issues exist. Big data, being gathered continuously on the edge, and summarizing that data to make decisions within a sub-milliseconds constraint is of great importance. Information that is necessary from a BI point of view will be pushed to the cloud. The Raima database is a key component within an IoT to Cloud computing platform and will help elevate such latency issues.

Potential Use Cases for Raima to The Cloud

Industrial Manufacturing: Applications within industrial automation such as condition monitoring, remote configuration, predictive maintenance and more require quick decisions close to the source that can benefit from a near real-time in-memory database with data movement into the cloud.

Fleet Management: Connected business solutions make the management of your fleet more efficient, safe and sustainable. The Raima database is ideally suited to work within a cloud solution when it comes to remote vehicle diagnostics, monitoring operation status of fleets, optimizing route planning, maximizing fleet utilization and more.

Marine: As with an industrial automation condition monitoring scenario, marine clients require the same sort of solution that can benefit from a on-premise Raima database system interacting with the cloud. Take an engine on a naval ship where an embedded system must manage vibration signals and patterns, gather statistical data for predictive maintenance, and then make that data available onshore to any cloud based system.

Automotive: The automotive industry is changing by leaps and bounds from being manual-centric to automated-centric where no longer is the vehicle infrastructure disconnected. The Raima database in combination with a cloud based system can play a key role together in delivering solutions under this new model. From location services for automated driving, to predictive maintenance statistical information, and connected vehicles providing real-time updates to one another. Such use cases require a reliable embedded database on the IoT edge device communicating continually with the cloud.

Oil and Gas: Capturing data in a Raima database located at the subsea floor or onboard an oil rig in the middle of the ocean requires a 24x7 solid database solution to collect massive amounts of data, then process, aggregate, and simply that data locally before replicating that information in near real-time to the corporate cloud based system for visualization and analytics. Raima together with a cloud based system can play a key role together in such a configuration.

Where Does Raima Fit in?

Modern data integration technology must be deployed in both on-premise/edge and in the cloud.

A major benefit of edge computing using Raima's RDM database solution is that it improves time to action and reduces response time down to milliseconds, while also conserving network resources.

When it comes to the cloud based enterprise or edge computing, it is all about the database. Whether you are mapping geospatial information, trying to figure out what is in stock, or trading stocks, RDM is a database management system that can make it possible to receive and deliver content from the edge to the cloud in a timely manner.

Raimá s new in-memory implementation was developed because reading and writing from memory is much faster than reading and writing from disk. In-memory computing has become the new go-to technology that is able to address more general purpose cases than it could just a few years ago. Edge and in-memory computing goes hand-in-hand because of the real-time requirement, Raima is well positioned to address these needs.

> Raima believes it can play a key role in solving a need in the market in the move toward edge computing. Depending on the implementation, time-sensitive data in an edge computing architecture may be processed at the point of origin by an intelligent edge device through input from different sensors and sent to an intermediary RDM-based server located in close geographical proximity to the client. Data that needs the power of a datacenter is then sent from RDM to the cloud for historical analysis, big data analytics and long-term storage.

Raima in combination with a cloud based technology will enable clients requiring **rapid deployments** of their applications in an **edge computing environment** where there is a distributed technology architecture in which client data is processed at the periphery of the network. This is done as close to the originating source as possible, providing a complete edge to cloud solution for clients.

Raima Common Denominator For All Verticals

Performance: RDM has been design and optimized for both on-disk and in-memory environments with a unique new architecture of the database file format, along with algorithmic optimizations. Every package includes performance examples that show how much faster RDM benchmarks against competitors, for easy comparison and evaluation.

Efficiency: RDM was developed with developer ease of use at the forefront. For C developers, the underlying core API of the RDM database is a modern and easy-to-use cursor interface. For pure SQL developers, an extensive SQL supports both SQL PL and stored procedures. RDM also supports the standard interfaces of ODBC (C, C++), ADO.NET (C#), and JDBC (Java), along with the development environments of Microsoft Visual Studio, Apple XCode, Eclipse, Wind River Workbench, QNX Momentics, etc. Developers are never locked out of using the language or interface with which they are most familiar. Raima has dedicated support for any language developers prefer.

Portability: The RDM database file format has undergone significant redesign. The new format allows direct copy/paste or movement from one device or platform onto another regardless of byte order or architecture differences. This feature lets developers work on any development host they prefer and then deploy the code and database anywhere. It also facilitates debugging on a more powerful development platform. If a target platform goes down, RDM allows the database to be copied directly onto any other target hardware and pick up right where it left off.

Raima Major Technical Benefits

Embedded: Raima Database Manager performance

RDM sets a new performance threshold for embedded databases. Designed to address future technology demands, it provides the highest-functioning database solutions for resource-constrained environments. RDM includes these major features: in-memory support, compression, optimized file format, snapshot, encryption, SQL, SQL PL, and platform independence – we like to describe Raima as: "develop once, deploy anywhere". Raima´s SQL implementation has been designed for embedded systems applications. As such, it provides a subset of the ANSI/ISO standard SQL that is suitable for running on a wide variety of computers and embedded operating systems, many of which have limited computing resources.

- **ACID-Compliance** - ACID transactions guarantee that when changes to a database record are made, that data is correct and no data is lost.
- **Compact Data Storage** - Automatic encoding and compression uses 25% less disk space on average.
- **Encryption** - AES encryption from 128 bit to 256 bit meets market demand for cybersecurity support and gives Raima clients peace-of-mind.
- **Embedded/Real-time Application** - Fully supports real-time system performance. RDM has been designed to meet the zero-administration requirements of an embedded application.
- **Fast In-Memory Performance** - An optimized in-memory implementation allows for faster transactions and results to support enterprises that need the utmost speed and performance.
- **In-Memory** - Support pure in-memory storage for both 32-bit and 64-bit applications. RDM can also be used in a hybrid in-memory mode where data loss may not be acceptable.
- **Multi-Core Scalability** - Maintain performance as demands on the system increase by adding further resources. Possible through SMP and thread support, plus the capability of scaling on more than one server.
- **Multiple Indexing Methods** - B-Tree, Hash, R-/R+ Tree, and AVL indexes are fully supported by RDM and available for users.
- **Platform Compatibility** - Develop once, deploy anywhere. Through Raima´s file format, you can mix and match operating systems and hardware.
- **Replication from edge to cloud** - Through the use of SymmetricDS, Raima can store data on the edge and easily replicate any of that data to the cloud.
- **Small Footprint** - RDM needs only 350k of RAM and minimal CPU speeds to fully operate.
- **Snapshots** - Snapshot isolation allows concurrent reads to the database when write transactions are occurring. RDM takes a frozen image of the current state of the system and that information can be read from without stopping writes.
- **SQL Optimization Support** - Fully featured and enhanced SQL support including SQL PL, Stored Procedure, and Triggers.

Appendix

Rdm Technical Summary & Deeper Dive

Summary

Raima has developed, sold and supported Raima Database Manager (RDM), a relational DBMS that runs in almost any computing environment, from mobile phones to embedded IoT computers to UNIX servers to the Cloud. RDM is a fast, small footprint, inexpensive database engine, provided by Raima as an SDK for Windows, Linux or UNIX development environments. For RTOS embedded and mobile targets (such as VxWorks, Integrity, QNX and/or iOS & Android), RDM's Windows or Linux SDKs will perform cross-platform development.

RDM has been used by thousands of programmers to create successful products, utilities or tools that have been distributed worldwide. Programmers use C, C++, Java, or C# to call a suite of APIs in RDM, or access it from 3rdparty tools through the ODBC Driver Manager.

RDM may be configured to run as a single process, single database program, or as a multi-computer, multi-process, multi-thread, multi-core, distributed database system of programs. And everything in between. Its SQL is ready for those who prefer SQL programming, but low-level API access is also available for advanced programmers who want to squeeze out the ultimate performance. For even greater performance, a database may be managed inmemory. ACID compliance means that on-disk databases are safe and always recoverable, while MVCC through snapshots and non-repeatable-read features allow fast reading or analysis of databases that are being concurrently updated.

Architecture – A Deeper Dive

RDM's runtime environment is composed as two powerful but well-defined modules:

1. The Runtime Library – This re-entrant linkable library becomes part of your executable program. It maintains a cache of database objects as it responds to function calls from your program.
2. The Transactional File Server – This tight, multi-user server interacts with one or more Runtime Libraries concurrently. It manages access to database files. The TFS responds to runtime requests to read objects, to lock objects, or to apply transactional changes.

Runtime Library

As a re-entrant library, RDM fully supports multi-threaded applications. Each thread may open a database and operate on it concurrently with the others.

As a linkable library, RDM operates on data kept in a heap-based cache. Its robust APIs give you full visibility and control over the data. SQL is available through a C-based API, but also accessible through 3rd party tools. Other APIs allow fine-tuning of database operations using a cursor view or an object-oriented view.

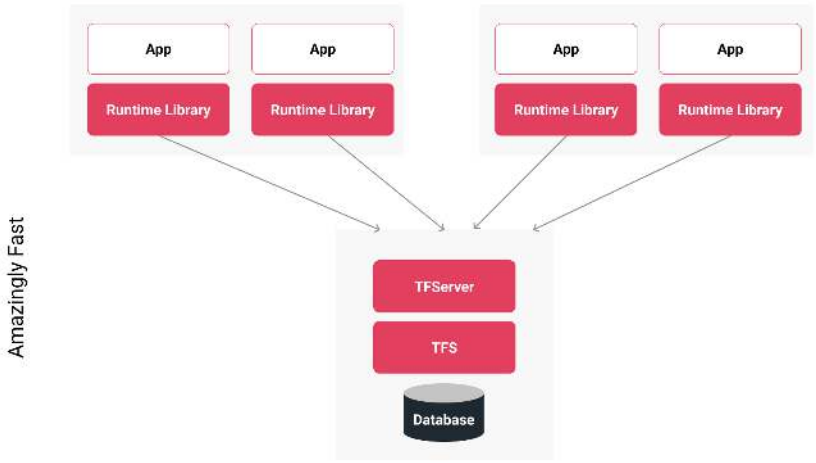
Transactional File Server

At its core, the TFS is a library of functions. These functions are called by the runtime library. If the TFS is running in a separate process, its functions are called as RPCs (Remote Procedure Calls) using TCP/IP between computers and shared memory within the same computer.

However, the TFS functions may be linked directly into your application also. This has significant performance benefits and simplicity in operation. It's faster because the Remote Procedure Calls become Local Procedure Calls (in-process). It's simpler because everything is running within your program and there is no separate process to start first.

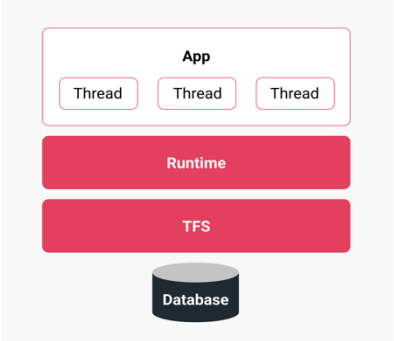
Configurations

Yes, the Runtime Library and TFS are powerful and well-defined, but they can be configured in several ways. The figures below show just a few.



Multi-Computer Configuration

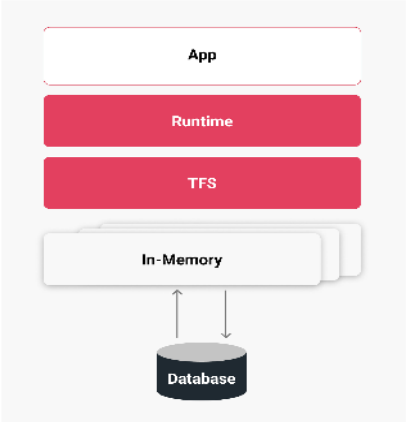
Even Faster



Multi-Thread Single Computer Configuration

When multiple computers are involved, they communicate through TCP/IP. If the runtime and TFS are on the same computer, shared memory is used to speed it up. But when the runtime and TFS are in the same process, the inter-process communication is avoided, resulting in even more speed.

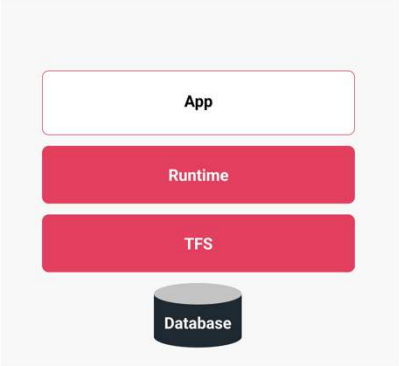
The Absolute Fastest



Single-Thread Configuration (Exclusive Access)

Multi-threaded applications are great for handling multiple windows on a screen, each with independent contents. Simpler, single-user applications have an advantage because there is no concurrent access to the database, hence no locking Now, load the database from disk into memory and you have database management with all the stops pulled.

Faster Than That!



Single-Thread Configuration (Exclusive Access)

The RDM in-memory database option allows for volatile (it goes away when the application stops) and persistent (loaded from disk and saved to disk) databases.

It's faster because there is no disk latency for reading and no waiting for disk writes during a transaction commit.

These are vulnerable to data loss if the application terminates without saving the data. Sometimes it's a risk worth taking!or waiting.

Key Functionality

Revolutionary performance optimized portable File Format

A new database file format will decrease database size through variability and compression. It is designed to meet the following requirements:

- Performance: Improved performance over previous version of RDM and competitor products.
- Compression: Store only the data needed per row to avoid underutilized space. Also column level
  compression to increase the packing of rows and reduce overall data file size.
- Portability: Database content will be independent of the CPU architecture, allowing databases to be
  copied between computers, or concurrently accessed by computers with different operating systems or
  CPU architectures.
- SQL/Core Compatibility: RDM will combine the Core and SQL database definition languages into a single
  DDL. The file format will support Core and SQL, as well as consolidating the catalog and database definition files. Primary and foreign key references will be a core level feature. And NULL support as a core level feature.

Full Multi-Core Support: Efficiently allocate transaction processing to take advantage of multi-core systems for optimal speed.

Pure and Hybrid In-Memory Database Operation: Configure your desktop database to run completely on-disk, completely in-memory, or a hybrid of both; combining the speed of an in-memory database and the stability of on-disk in a single system.

Multiple Indexing Methods: B-Tree, Hash, R-/R+ Tree, and AVL indexes are fully supported by RDM and available for users.

- Better Performance through Scaling Out: Easily achieve true horizontal scaling across clustered or distributed systems without the need to re-write of your application.
- True Global Queries: Connect any application to one or more databases and query them as if it is a single instance. Perform global, locally or across a network, to multiple database instances with no regard for where the data is located.

Database Cursors: The addition of cursors to the standard library allows for an easy-to-use, natural traversal of records in the database.

- Dynamic DDL: This feature is important to meet customer feature demand for the ability to create and alter database and table definitions, which enhances the customer application upgrade scenarios.

SQL/PL: SQL Persistent Stored Modules are a major ease-of-use enhancement in RD. This feature follows the ISO standard for SQL scripted procedures that are stored together with the database and available to all database users.

Shared Memory Protocol: Improves performance with clients on the same computer through the addition of shared memory as a transport for communication between the application and the TFServer.

- Application-specified Memory Limit: allows the application to limit the amount of memory used by the RDM runtime system and, optionally, provide a pointer to a memory buffer within which the memory will be allocated.

New Data Types: Three new data types, including Date/Time/Timestamp (Core level), BCD (decimal), GUID (UUID).

- Bulk insert API Function: The Bulk Insert API function is a new performance optimization API to efficiently insert large quantities of data at the Core level.
- Unrepeatable Read Isolation Level: Support for lockless reading. This is a new isolation level that allows any committed data to be read without first requesting a read lock. Since there are no locks, data may change without notice. When this is acceptable for the application, it is much faster.

Encryption: Encryption of the database files using the Rijndael/AES algorithm for encryption or decryption is now available. The algorithm supports the use of 128, 192 or 256 bit keys.

1. **SQL enhancements:**

- Update Statistics – provides for the collection of data distribution statistics so that the SQL optimizer can make more informed execution plan choices.
- Rowid Primary & Foreign Keys – rowid primary keys allow individual rows of a table to be directly accessed thus providing optimal retrieval performance without having to incur the cost of a separate index.
- Improved Group/Order By Performance – Group by processing performance has been significantly improved in RDM Order by sort costs have also been reduced.
- New Data Types – support was added for the previously mentioned new Core types, decimal (BCD) and guid (SQL already had date/time/timestamp support).

2. **Replication:** Cross platform database replication through SymmetricDS.

Rest API: New HTTP REST API enables web developers to utilize the full power of the RDM database system through standard and simple GET/PUT requests to the server.

Technical Specs

Database

- Maximum Databases Open Simultaneously: No Limit
- Maximum Records Per Database: No Limit
- Maximum Size of Database File: Limited only by file system
- Maximum Tables Per Database: No Limit
- Maximum Records Per Table: No Limit
- Maximum Record Size: 32 kb (excluding BLOB or VARCHAR)
- Maximum Fields Per Table: No Limit
- Maximum Keys Per Database: No Limit
- RAM Requirements: User configurable, minimum 50 kb
- Code Footprint: Starting at ~270 kb, depending on OS and database features

Modes of Operation

- Single-Process, Multi-Thread
- Multi-Process, separate Transactional File Server
- Multi-Process, shared in-process Transactional File Server

Data Types Supported

- BLOBs
- Character
- Widechar
- Varchar
- DBADDR (ROWID)
- Floating Point – 32bit and 64bit
- Integer 0 8bit, 16bit, 32bit and 64bit
- C Struct (Core only)
- Data/Time/Timestamp
- BCD (SQL Decimal)
- GUID

Additional SQL Data Types:

- Binary
- Unicode

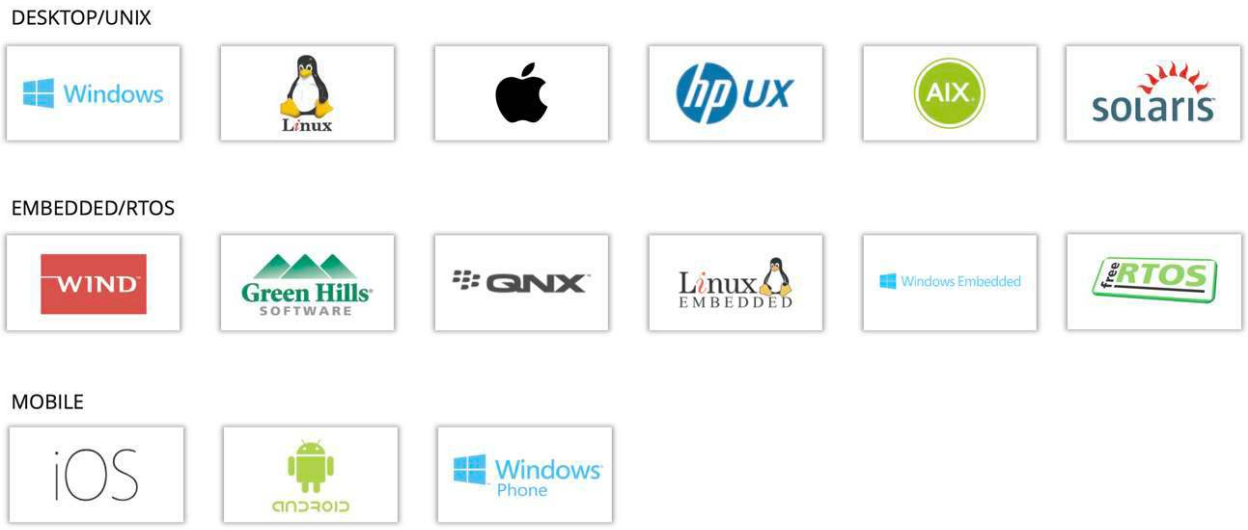
Data Providers and Drivers: Interoperability

- ADO.Net 4.0 Data Provider
- JDBC 4 Type 4 Driver
- ODBC 3.5 Driver

For more in-depth technical information please see the technical whitepaper and the Raima documentation.

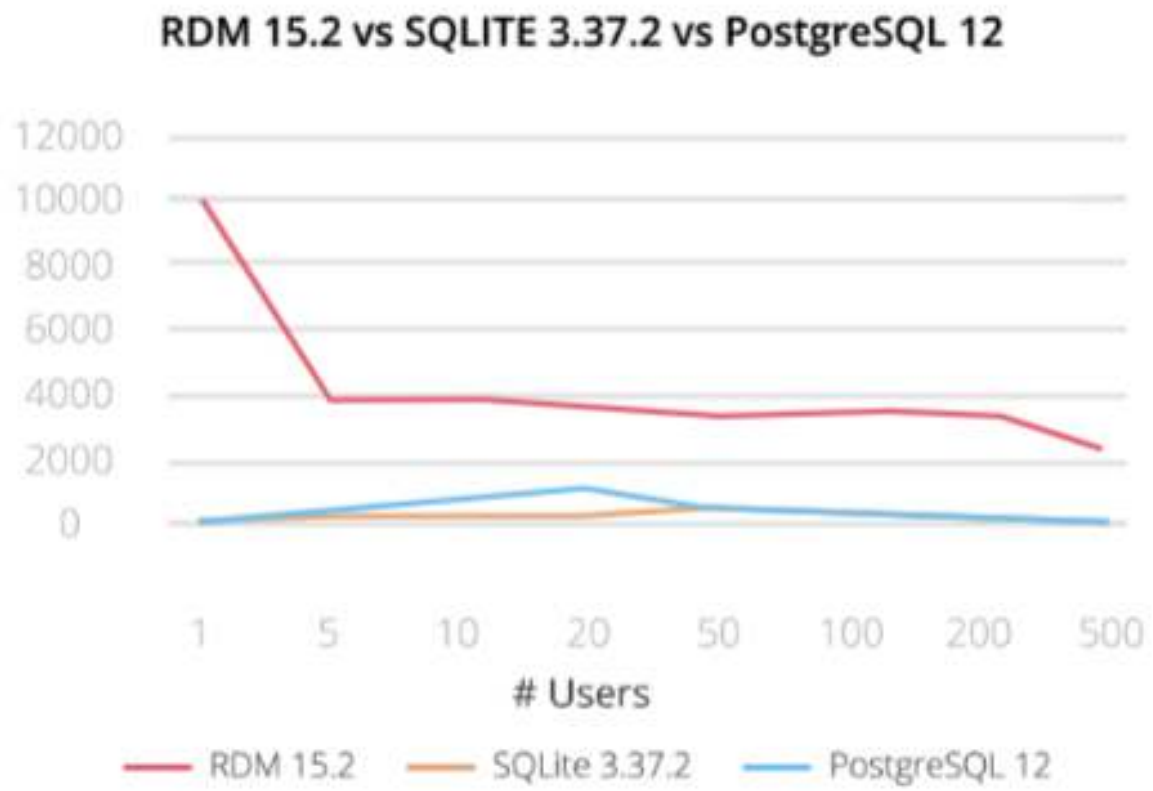
Manage Data across Platforms:

Our products are platform independent and optimized for the most popular operating systems: RDM provides seamless integration between different data sources and can easily be configured to move data from small low powered embedded devices up into larger enterprise systems.



RDM Performance Benchmarks

RDM performs better than any competitor within a multitude of systems and environments. In the industry standard TPC-B test, our disk-based performance is able to process over 2,000+ more transactions than our closest competitors. The following test is run on a raspberry Pi 4 Model B with Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1. 5GHz and 8GB LPDDR4-2400 SDRAM with a 256GB SD card running ARM Linux.



To create such increased efficiency, RDM uses a “packed” row format in the database engine. These packs contain byte streams that are both compact and portable across different OS and processor platforms. So, application developers can develop on one platform and deploy on another. This feature alone decreases time to market for enterprise applications.

The RDM Packages

Raima RDM comes in 2 different packages as follows:

RDM Core

RDM Core package provides a comprehensive and easy to use low-level cursor C API for ultimate control while also providing a C++ API for object-oriented programming. This is typically used in applications designed for edge IoT devices where performance and footprint is of great importance.

RDM Enterprise

RDM Enterprise package provides not only the core cursor C/C++ API's and SQL API's with SQL PL for application developers that are familiar with SQL and want to shorten development time, but also, ADO.NET for C#, JDBC for Java, a comprehensive ODBC driver and more. The enterprise package is designed for multiple industry standard API's to connect to 3rd party tools for purposes such as replication, reporting, analysis, and administration.

Download a free trial of RDM Enterprise!

Example Customers

Industrial Automation

Types of Industrial Automation Solutions:

- Maintaining parameters, configurations, recipes for manufacturing processes
- Logging events, errors, alarms from systems and processes
- Live data capture
- Display customization
- Condition monitoring – predictive maintenance
- System optimization
- Supplier Relationship Management – Supply Chain Performance

ABB	• **Application:** Batch Data Manager • **OS:** Windows X86 • **Description:** ABB embeds Raima's RDM database inside their Batch Data Manager solution used in process control for chemical & pharmaceutical plants. This application is used to create Batch control recipes that are compiled, downloaded and then run in ABB's embedded controllers. RDM database stores this data
AVEVA	• **Application:** "InBatch" • **OS:** Windows X86 • **Description:** Wonderware embeds Raima's RDM database solution within their InBatch batch control management software to manage recipes, configuration data and materials.
SIEMENS	• **Application:** "SIMATIC WinCC SCADA" System • **OS:** Windows X86 • **Description:** Siemens embeds Raima's RDM database within their SIMATIC WinCC SCADA System, a scalable process-visualization system with numerous high-performance functions for monitoring automated processes. This system utilizes the Raima solution as its core transaction database.
EDMUNDSON ELECTRICAL	• **Application:** "EPCS (Electronic Profit Centre System)" • **OS:** Linux X86 • **Description:** Edmundson Electrical embeds Raima's RDM database inside their back office system distributed in over 264 locations managing data critical to maintaining their wholesale business.

Energy & Natural Resources

Types of Industrial Automation Solutions:

- Maintaining parameters, configurations, recipes for manufacturing processes
- Logging events, errors, alarms from systems and processes
- Live data capture
- Display customization
- Condition monitoring – predictive maintenance

GE POWER	• **Application:** "ALSPA ControPlant" • **OS:** Windows X86 • **Description:** GE Power embeds Raima's RDM database solution within their historical data recording application that is part of GE's mission critical control systems for power plants. The database collects, stores and manages this critical historical information. • **Application: "DS Agile aView"** • **OS**: Windows X86 • **Description:** GE Grid Solutions utilizes Raima's RDM database solution within their DS Agile aView HMI software application within the overall DS Agile Digital substation automation system. The database manages substation control points, alarm data, archive & logging.
Schneider Electric	• **Application:** "ezXOS" within OASyS DNA • **OS:** Windows X86 • **Description:** Schneider Electric embeds Raima's RDM database solution within their EasyXOS Operator Station component which is a customized SCADA HMI interface to Schneider's OASyS DNA product. The Raima database provides the management of data for oil & gas companies for how they set-up & manage their displays.
Schlumberger	**Schlumberger Limited:** • **Application:** "Application within RX5 Data Acquisition System" • **OS:** Linux X86

	• **Description:** Schlumberger runs Raima's RDM database within an application built into the RX5 Data Acquisition System. The application running RDM is placed on oil rigs and used by Schlumberger engineers to provide offshore drilling services for unconventional oil and gas environments to optimize production and maximize recovery. The RDM database is used to log data gathered from the oil wells.
AkerSolutions™	• **Application:** Vectus - "Future Generations of Aker's Offshore Control Technologies" • **OS:** Host Linux – Target QNX PPC • **Description:** Aker Solutions embeds the Raima RDM database to handle high volumes of information gathered from subsea oil production. The database needed to be compatibility with embedded and conventional systems and deliver a high degree of robustness to maintain data integrity in the offshore environment where communication links may suffer disruption and interruption.

Aerospace & Defense

Types of Aerospace & Defense Solutions:

- Tactical information
- Mission planning
- Live situational analysis
- Live data capture

GENERAL DYNAMICS	• **Application 2:** "MHP" - Marine Helicopter Project • **OS**: Linux & Solaris X86 • **Description:** General Dynamics Canada embeds Raima's RDM database solution within the MHP Integrated Mission Data Management System which utilizes the Raima database as a contact file library allowing the military to have a well-organized Mission Data Management System for Mission Preparation and Analysis.
	• **Application:** "AWACS" - Airborne **Warning and Control System** • **OS**: Host Windows – Target VxWorks X86 & PPC • **Description:** Boeing embeds Raima's RDM database within the Radar electronics system aboard the AWACS providing airborne surveillance and command & control battle management functions for both tactical and air defense forces. RDM is used to manage data collected from the antenna on top of the plane. Data is gathering radar pulses and other RF input and signal identification information to identify the signals of enemy craft and/or other potential concerns in the area. • **Application:** "Inventory application for the Acalis Sentry product" • **OS**: Host Windows – Target Integrity PPC • **Description:** Boeing Secure Computing Solutions provides this inventory application supporting their Acalis Sentry embedded app. that will allow customers to keep track of data associated with a part, what they did to the part, control inventory of the chips sent out, what chips were received, correlate the chip to the board it was installed on when the board returns, then it goes away.

	• **Application 1:** F16 Test Stands • **OS**: Linux X86 • **Description:** Lockheed embeds Raima's RDM database solution within their F16 pre-flight test stands and uses the Raima database to store vehicle maintenance status and information gathered from the testing procedures ran by these test stands to help identify necessary repairs needed to conduct the safe flight of the aircraft. • **Application 2:** F2 Flight Simulators • **OS**: Linux X86 • **Description:** Lockheed embeds Raima's RDM database solution within their Ground Based F16 & F2 Flight Simulator OFP (Operations Flight Program). The Raima database is used to store flight simulation data and parameters.
	• **Application:** "777 Cabin Management System" • **OS**: Windows X86 • **Description:** BAE embeds Raima's RDM database solution within their 777 CSS Configuration Database Generator application which stores the airlines configuration of the 777 jet for their Cabin Management System. The Raima database stores data used to configure lighting, intercom operability, seat buttons and more.
	• **Application:** Mission Control Applications • **OS**: Windows X86 • **Description:** Elbit embeds Raima's RDM database solution within their mission control application. The Raima database provides real-time in-flight data management for airborne systems.

Transportation/Automotive

Types of Transportation Solutions:

- Live data capture
- Location data
- Condition monitoring

Types of Automotive Solutions:

- Infotainment
- POI

CUBIC Global. Innovative. Trusted.	• **Application:** "Validator" - Bus Fare Rules & Authorization Application • **OS**: Host Windows – Wind River Linux ARM • **Description:** Cubic embeds Raima's RDM database solution within their Bus Fare Rules & Authorization Application for buses, subways and more. The database collects, stores and manages passenger information.
CARIAD A VOLKSWAGEN GROUP COMPANY Audi Volkswagen	• **Application:** ECU (Electronic Control Unit) in Next Generation Autonomous Vehicles • **OS:** Host Windows – VxWorks ARM • **Description:** CARIAD embeds Raima's RDM database solution inside the camera and ECU of the next generation electric vehicles. The database collects data from all sensors around the vehicle, combines the results with map data, stores it into the RDM database engine and then uses Raima's rapid data retrieval and processing API's to make nano-second decisions for the car's advanced ADAS and visualization system.
Caliper	• **Application:** "Maptitude, TransCAD, TransModeler" • **OS**: Windows X86 • **Description:** Caliper integrates Raima's RDM database inside their Maptitude (GIS and mapping software), TransCAD (GIS transportation planning software), and TransModeler (Traffic simulation package for traffic planning and modeling tasks) solutions. Raima's database is used at the back-end of the user interface to manage session and geographical data.

Telecom & Networking

Types of Telecom & Networking Solutions:

- Topologies
- Network routers, multiplexers, switches
- Network security
- Network configuration
- Network subscriber management

	• **Application:** "Juniper Networks Steel-Belted Radius (SBR)" • **OS**: Linux X86 & Solaris SPARC • **Description:** Juniper embeds Raima's RDM database solution within their Juniper SBR software application which is a core component of enterprise and service provider networks providing centralized user authentication and access policy management. The Raima database is used as a cache of configuration data and as a solution for storing and managing access information.
	• **Application:** "FSP 3000 & FSP 150 F3" • **OS**: Host Linux – Target Linux X86, PPC, Arm • **Description:** ADVA embeds Raima's RDM database solution within their FSP 3000 optical transport solution & their FSP 150 F3 family of Ethernet access products. The Raima database is used to manage configuration data that describes the attributes of users.
	• **Application:** "Multikom IP communication system" • **OS:** Host Linux – Custom Linux PPC, Arm • **Description:** Elvys uses RDM within their Multikom IP communication system to store information about recorded calls, users activity or GPR positions of digital radio network subscribers. It runs in-memory on their custom real-time OS which was a critical requirement.

Healthcare

Types of Healthcare Solutions:

- Medical testing equipment
- Patient data
- Device messaging
- Blood analysis

QuidelOrtho™	• **Application:** "Vitros 5600 (4.3), Vitros 3600, Vitros 4600" • **OS**: Host QNX – Target QNX X86 • **Description:** Ortho Clinical Diagnostics embeds Raima's RDM database solution within their VITROS 5600 (4.3), VITROS 3600 and VITROS 4600 product-lines to store patient fluid results to analyze blood & serum levels.
infor	• **Application:** "Cloverleaf® Integration Services" • Windows X86, Linux X86, Solaris SPARC, AIX PPC • **Description:** Infor embeds Raima's RDM database solution within their Cloverleaf application which is a message hub or broker that receives messages moving from one medical system to another. It receives these messages and stores them in the Raima database for persistence while messages are being processed to guarantee delivery of the data even if the power fails.
BECKMAN COULTER	• **Application:** "UniCel® DxC 600" & "DxC 800 Synchron® Clinical" • **OS**: Host QNX – QNX X86 • **Description:** Beckman embeds Raima's RDM database solution within their UniCel and DxC products to help manage all of the instrument's vital information from order entry through results reporting including patient data, quality control, calibration, chemistry configuration, instrument setup and operational data.

	• **Application:** "IMMAGE Immunochemistry System" • **OS**: Host Linux – Target QNX X86 • **Description:** Beckman embeds Raima's RDM database solution within their IMMAGE Immunochemistry system. The RDM database is used to manage information vital in the testing for specific proteins and therapeutic drugs.
Instrumentation Laboratory A Werfen Company	• **Application:** "ACL" Product-lines • **OS**: Host Windows – Target VxWorks X86 • **Description:** Instrumentation Laboratory embeds Raima's RDM database solution within their ACL Hemostasis Testing Systems. The Raima database stores and manages patient blood analysis results enabling surgeons to know viscosity of patient's blood.
SIEMENS	• **Application:** "RAPIDPoint 500" • **OS**: Windows X86 • **Description:** Siemens embeds Raima's RDM database solution within their Rapid Point 500 medical fluid testing equipment. The Raima database stores and manages patient fluid information. •

Banking & Financial

Types of Banking & Financial Solutions:

- ERP – sales, inventory, scheduling, billing, accounts
- Stock trading
- Work flow management/control
- Performance measurment
- POS
- Collections

DOW JONES	• **Application:** Newsroom Support System • **OS**: Windows X86 & Solaris SPARC • **Description:** Dow Jones embeds Raima's RDM database solution within their newsroom support system. The Raima database is used as a queue for work flow.
NSE	• **Application:** NSE Trading System • **OS**: Windows X86 • **Description:** NSE embeds Raima's RDM database solution within their trading system. The Raima database is used as reliable stock trade data storage.
SILKEBORG DATA	• **Application:** "PC Arkiv" • **OS**: Windows X86 • **Description:** Silkeborg embeds Raima's RDM database solution within their PC Arkiv payroll management system. The Raima database is used to store employee data and income information.

Want To Know More?

Please call us to discuss your database needs or email us at info@raima.com. You may also visit our website for the latest news, product downloads and documentation: www.raima.com.

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