



Real-time Distribution System™, RDS™ Warehouse Execution and Control System Overview

Company Background

The Numina Group brings *Smarter, Faster, Better Automation* to material handling in all phases of order fulfillment, distribution, and shipping operations. Numina Group's Real-time Distribution Software, RDS™ is based on over twenty four years of real-time software development, methodologies, operating system and industry knowledge. Since 1986, we have developed software and distribution automation systems for both end users and OEM material handling equipment vendors. We have an excellent track record and reputation for providing "**Bullet-Proof Systems**" that meet or exceed specifications.

Warehouse and Distribution automation requires know-how, proven software and a team of experienced professionals to obtain the desired ROI payback and process improvement results. **Software is the key component** to obtaining the desired results.

RDS™ is a modular Linux based open system platform that is proven in real-time barcode or RFID data driven manufacturing and distribution control and execution applications. RDS™ manages distribution and manufacturing plant floor product movement and the material handling automation equipment used in order picking, routing, validation, labeling, and sorting applications.

The solutions and products we deliver offer the industry's highest performance, scalability and reliability. RDS™, with its pre-developed application control modules, provides solutions from basic plant floor data collection to sophisticated process optimization and means to add the latest technology including; **voice directed picking and pick-pack and ship order fulfillment process**.

Overview

RDS™ is a Warehouse Execution and Control System, referred to in the distribution industry as WCS. It includes real-time (sub- millisecond) multi-function control and a plant floor ram-resident high performance SQL database platform.

RDS™ manages the connection between ERP/WMS Systems and the plant floor real time data collection, control tasks, and execution of business rules to control and manage material handling automation equipment. RDS™ integrates the host system with devices such as barcode scanners, RFID, voice directed picking, pick to light, real-time high speed sorters, conveyor, in-motion scales, dimensioning, print and apply label applicators and other automation devices. RDS™ scales from small applications (such as our X-Press PAL Print and Apply Systems) to high performance, millions of transactions an hour requirements found in order fulfillment sorting applications

RDS™ meets the needs of manufacturing and distribution control applications with its family of communication modules that connect to SAP, Oracle, IBM I-Series, or other Host / Warehouse Management Systems (WMS).



Beyond Programmable Logic Controllers (PLCs) traditionally used for the conveyor and plant floor machine control tasks; RDS™ effectively unifies device level control, information and product tracking with supervisory and host communication. RDS™ acts as a gateway to plant floor devices performing control, device management, data and optimization control rules while managing the flow of data between the host ERP/WMS.

RDS™ is modular and competitively priced, supporting single print and apply labeling requirements, to a full range of automation applications found in distribution and manufacturing. RDS™ handles database lookups and user interfaces and operation reporting without interruption of the real-time control and communication tasks

RDS™ Automation Modules Include:

Data Tracking Product barcode and RFID data collection from plant floor or RF terminals

Receiving/Cross Docking In-bound audit with Print and Apply Labeling

Cartonization Order carton cubing selection for pick to case picking based on item quantity, cube and weight

Order Release Optimization balance work load with order release across work zones to match ship and delivery rules

Dashboard User interface with visibility and business intelligence

Pick Execution RF, Pick to Light and Voice Directed Picking

Carton Zone Routing Conveyor routing for pick to case orders

Order Validation Inline weight and Vision Audit

Conveyor Control and Diagnostics

Packman Void fill, pack sheet generation and /insertion and carton sealing

Sortman All varieties of sorter controls including Shoe, Tilt-Tray, Bombay and Cross-Belt

X-Press PAL™ Automated Print and Apply of Shipping and Compliance Labels

One-Step™ Print and Apply of combination Packing Slip and Shipping Label

True Real-time Control

One of the most confusing terms in automation software is the use of the term real-time. RDS/Trak™ is a **true real-time sub millisecond** (100 microseconds) control that runs in a guaranteed Linux real-time task. RDS™ contains a control language called Trak. Trak is a versatile multi-function event based control engine that performs controls at speeds beyond PLC's. Numina Group has developed a family of pre-developed control functions/modules for conveyor control, high-speed sortation packaging control, printer/applicator labeling, vision capture/inspection, and scan/weigh/cube in-line automation requirements. Trak is ideally suited to distribution and manufacturing applications that require closely coupled database transactions and data driven control decisions occurring in a fast and guaranteed time interval.

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The RDS/Trak™ platform is built from the following components:

PC type processors, from small industrial hardened computers to large RAID-array rack mount servers

Linux operating system (currently Red Hat 9, Red Hat Enterprise 4, and Fedora Core 5 are supported)

RDS™ collection of libraries, utilities, messaging tools, methodologies, and pre-developed application control modules

MySQL Database

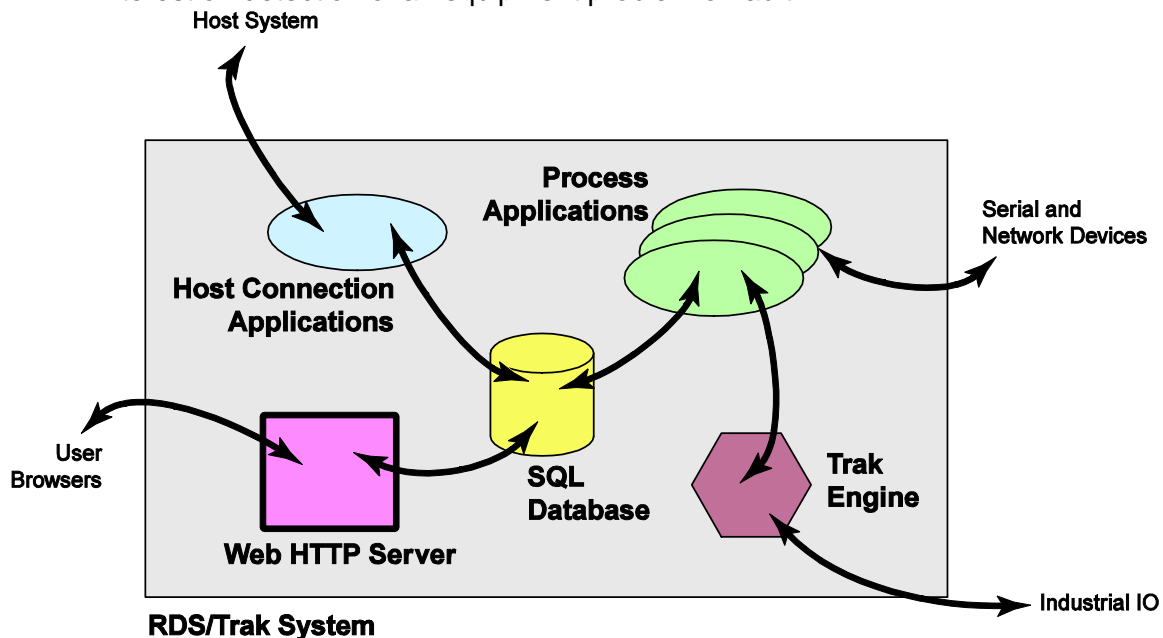
Apache HTTP Web server

RTAI real-time kernel extensions

Direct Connect Interface Modules to seamlessly integrate automation directly to SAP (support for direct RFC and XML messaging), IBM with the Java Toolkit, JDBC, ODBC, and virtually any WMS / ERP Systems. Socket Message tool set and other interfaces are easily supported.

Dashboard browser based User interface screens and reporting tools to provide easy to use and view equipment and operation performance data

Zooming Graphical user display and equipment interactive web based diagnostics display a tool, similar to Google Earth, that zooms the user display to the area of interest on detection of an equipment problem or fault





The core components (underlying tool set) of RDS/Trak™ are:

Process Applications A collection of interacting process applications are the core of RDS™. Following a divide and conquer methodology, each process typically handles one independent part of the system, such as controlling a printer-applicator, a barcode scanner, or a divert. This allows a high level of past application control code re-use, a distributed development effort, and a robust and flexible response to changes in requirements. The modular development environment includes a high speed inter-process data messaging tools to manage data transactions between the real-time control and the SQL database.

Trak Engine Based on a real-time extension to the operating system kernel, the Trak Engine performs PLC control at an effective scan time of 200 microseconds. The event based control language is ideally suited to product tracking and data driven control decisions through its memory based interface to the application layer. This design eliminates the typical bottleneck of communications and diagnostic development typical of mixed PC-PLC solutions.

SQL Database The MySQL database engine is used to hold all persistent state data on the system. My SQL is a very high transaction rate database that operates ram-resident allowing RDS™ to operate with large lookup datasets. By incorporating a full SQL database RDS™ can retain historical operational information with easy data access, and multi-user support.

Host Interface The Host Interface is responsible for spooling information up and down between RDS/Trak™ and the Host ERP system. The host interfaces may use ERP-specific libraries (such as IBM's JT/Open for the AS/400 or JCo Java connector for SAP JDBC to Oracle, DB2 and SQL Server) to greatly reduce the host programming burden during the development of interfaces. Also, transactions to the Host are regularly queued so that Host system downtime for backups or upgrades does not lead to a loss of data.

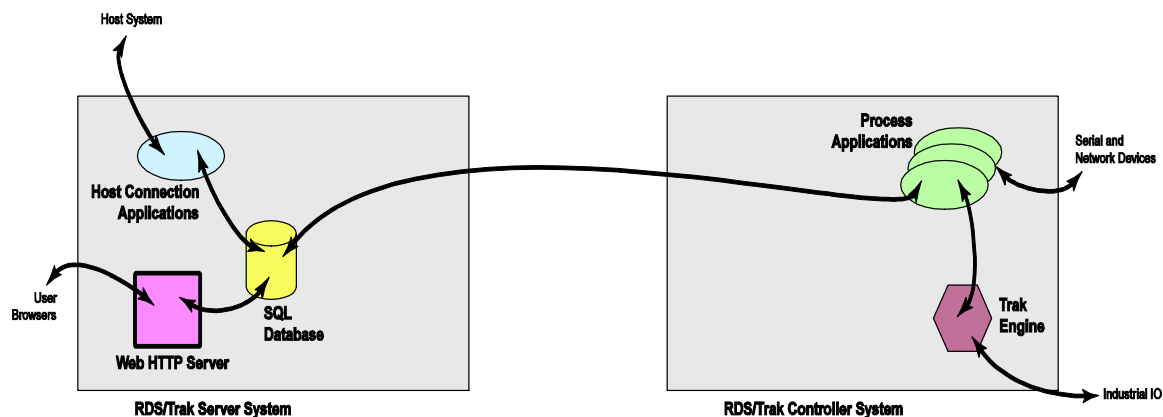
Web Interface User interfaces to RDS/Trak™ use our Java Dashboard and a family of pre-developed user screens served out through a Web browser. The set of pre-developed operator interfaces include alert screens, equipment and operation status and, diagnostics with graphical annunciation. All operational data is time-stamped event logged; configuration parameters such as receipts, sort table maintenance and supervisor actions are stored in the SQL database. Any PC on the corporate intranet network with a browser and authorized password can view and access the data.

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Platform Reliability and Redundancy

With the exception of direct serial links from scales, etc. used for the process applications and the plant floor IO link, all of the connections and data messaging between the major components are *network transparent*. This means that the system can scale to meet any size requirements and operate even if the components are hosted on separate machines over the network.

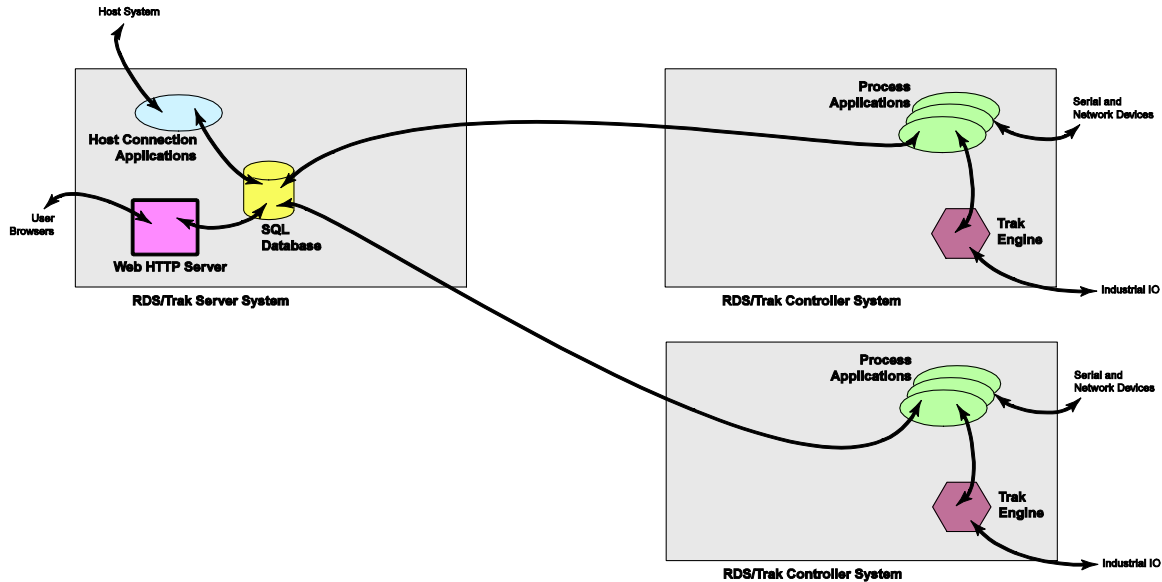
An example is shown below:



The above diagram shows an example of the SQL database, the Host communication and Web Interface executed by a Server that can be located in a controlled environment such as the corporate computer room. The process applications and the real-time control engine execute on an industrial hardened computer system close to the plant floor devices and control IO panels. A solid state disk can be supplied with the RDS™ Trak to survive extreme temperature and vibration requirements.



The RDS™ Trak architecture allows for a distributed “Cluster Control” architecture:



Above, two separate multi-function RDS/Trak™ control computers operate at different locations remote from the central server. As all processes share the same database, all three machines act as one system. Any number of remote systems could be integrated together, giving the benefits of distributed control without losing the simplicity of a single interface and database.

This also provides redundancy and high availability of the controls. Should a primary controller fail, a second controller can be on-line and ready to take over control without loss of data, waiting only for a switchover of the serial breakout cable and the IO cable, followed by the execution of a single script.

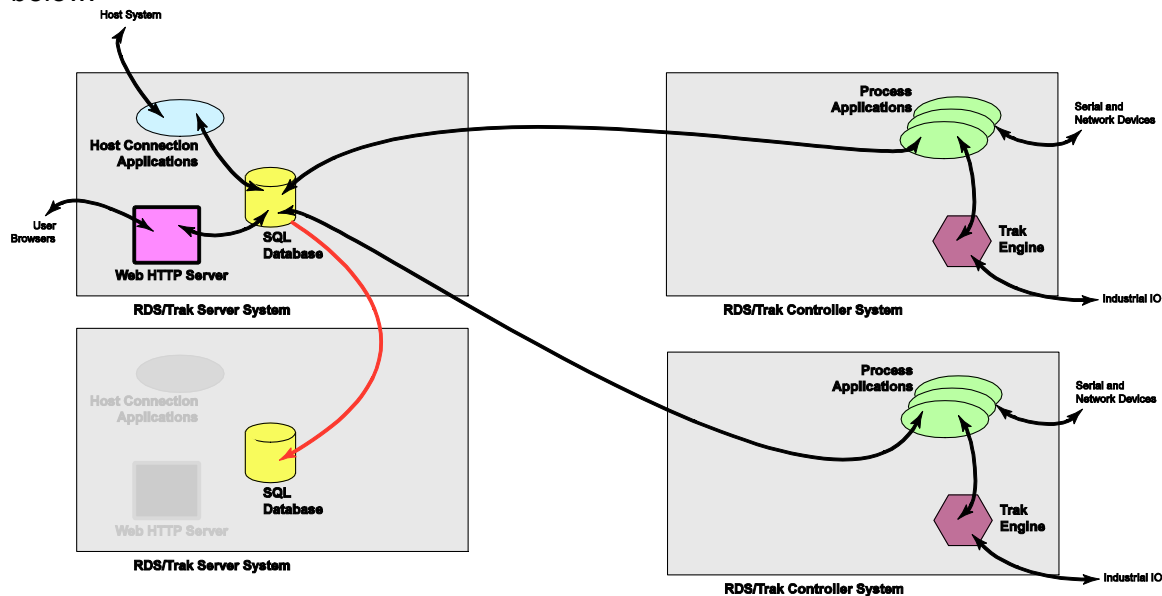
Shown below is the standard industrial hardened Pentium Computer supplied on mission critical applications. Temperature rated to operate at up to 55 degree C.





Linux High Availability Heartbeat plus Distributed Replicated Block Devices (DRDB)

True redundancy at the database and application are supported at the Server level as shown below:



RDS™ incorporates the Linux-HB commonly referred to as Linux Heartbeat. This solution provides both redundancy of the application and the database server. Replication of both the application and the database over Ethernet is shown in red in the diagram. Heartbeat messages are sent over Ethernet between the Primary and Secondary Servers. If a failure is detected in the Primary Server, fail-over occurs through “IP Address Failover”. Connections from the remote machines would automatically fail over to the Secondary Server.

Further details on Linux high availability can be found at <http://linux-ha.org/> or request the White Paper on MySQL High Availability from the Numina Group.

Conclusion

RDS™ is a Scalable Warehouse Control System with reliability and flexibility beyond the traditional limits of competitive systems. RDS™ integrates control and information management, voice picking automation, optimizes order release processing, routing and shipping processes. RDS™ is proven in 100's of distribution automation applications including conveyor control, carton/tote order routing, pick-pack-ship, in-line order validation, Tilt Tray, Cross-Belt, Bombay and Shoe Sorter control applications.

Proven Performance, Scalability, Reliability, Redundancy, Connectivity and Ease of Use positions RDS™ as the platform of choice for distribution and real-time control automation. Call us a 630-343-2600 to find out more about RDS™ and how Numina Group's Team of Automation Professionals can help you improve your manufacturing or distribution operation.