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Briefing

Golden Code^{TM} REXX Libraries for OS/2

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Executive Summary

This document serves as an introduction to Golden Code Development's extensive set of REXX external function libraries. The intended audience is corporate IT professionals and software developers using the REXX language. This document will provide an overview of the functional capabilities of these libraries.

REXX is a powerful tool that is intrinsic to the OS/2 environment. The language can meet many requirements from simple automation and integration to daemon or application processes. While REXX cannot directly interface with native OS libraries, a native library can be easily extended to provide an "external function" interface for REXX programs. On OS/2 there exist many libraries of external functions.   However, these libraries are often used for a single purpose, were created by a tens or hundreds of different organizations or individuals and are usually unsupported. This is not the case with the Golden Code REXX libraries. These libraries have been carefully designed and packaged by a small team of developers. The functionality was created because of the needs of specific enterprise customers so the functions are both well tested for and well suited to the enterprise environment. In addition, these libraries are continuing to get improvements as requested by clients. Golden Code will provide a high level of support for these libraries. Each library and API is completely documented in HTML form including sample code, error codes etc.

Golden Code has created a set of three libraries that cover the widest range of APIs ever collected for REXX programmers. For the first time a full set of libraries exist with a consistent API and design. This will increase development productivity and provide a consistent and stable set of tools. Most importantly, this offering provides access to new and powerful APIs in that have never before been made available. This set of tools can provide developers with a range of function unparalleled in any other REXX library offering available.

Starting in 2003, these libraries will be ported to both Linux and Windows environments. This will facilitate the migration of enterprise OS/2 environments to other platforms, without losing the strong function and management capability that the current OS/2 systems enjoy.

Product Overview

The functionality can be categorized into 4 main areas:

- general REXX productivity aids and tools
- REXX interpreter APIs
- system access, control, management
- IP networking
- spooler and printer access, control and management

The first two areas are packaged as a library called RXMISC.DLL. The next two areas are packaged as RXIP.DLL and RXPRT.DLL respectively.

Many of these APIs have never before been available from REXX.

All libraries can be loaded and used from a command-line boot such as Recovery Choices, CID or some other diskette or CD-ROM boot environment. Functionality that requires the WorkPlace Shell (WPS) or Presentation Manager (PM) is gracefully disabled, while allowing all other functions to operate normally. REXXUTIL and most other external function libraries do not provide this same capability.

Since REXX code can easily execute commands in the system shell (e.g. CMD.EXE), any batch oriented command line tool can be leveraged from REXX. In some cases function in these libraries can be accessed in other command line utilities. However, by having this functionality directly within the REXX language provides the following advantages:

1. faster performance
2. direct access to output data in REXX variables
   - function output is directly inserted into variables instead of being redirected into a queue or file and then scanned and parsed
   - stem variables are used for both simple lists as well as more complex structures and lists of complex structures
3. direct usage of REXX data structures on input
   - many command line tools don't provide a mechanism to input large amounts of data, REXX can easily and naturally handle this
   - stems are used to make it easy to structure simple and complex data
4. consistent programming interface rather than a custom interface for each command line tool
5. simple packaging (3 DLLs to distribute) instead of hundreds of standalone utilities (and possibly their libraries)
6. less modules and code to support
7. better support
   - a single supplier
   - all functions are supported
   - many command line tools that are available may be out of support or from suppliers that don't exist

RXMISC

RXMISC provides a wide range of functions in the general and system categories. It provides the capabilities of the built-in REXXUTIL.DLL as well as much more.

General APIs

These interfaces are designed to enhance productivity and provide a powerful set of basic tools that are not platform specific.
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File Editing - Line and byte oriented helpers for quick editing of text or binary files. Provides a very powerful set of search, comparison and search/replace functions. Provides a quick way to load/save a text file to/from a stem variable.

File System Management - Move, copy, rename, delete, split, merge files and directories. Query and set timestamps, sizes and attributes of files. Quickly obtain lists of directory trees, available drive letters. Also provides functions to calculating disk utilization on a directory basis.
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Regular Expressions - Process regular expressions on simple variables, stem variables and files. This is a complete replacement for an external GREP utility as well as providing non-file regular expression handling.

Logging - This set of APIs is a simple, standard mechanism for logging. It is multi-process and multi-thread safe. Each log entry is written to a line in the currently open log file, with a time/date stamp and the process ID and thread ID of the writer.

Stream Text Editing - Provides a "SED" interface directly from REXX. This is a complete replacement for SED.

INI File Access - Provides direct access to OS/2 style binary INI Files and the very generic "stanza-based" INI files (e.g. protocol.ini). These functions are designed for high performance. Code converted from the REXXUTIL.DLL SysIni function can see a performance increase of over 1000%! Please note that the OS/2 binary INI file function is platform specific to OS/2.

ZIP/UNZIP Compatible Compression - ZIP files can be created, added-to, listed, unpacked, removed-from and split into pieces. This library is a completely InfoZIP and PKWARE ZIP compatible implementation.

REXX Interpreter APIs

MacroSpace - Provides an interface to the REXX interpreter's cache of functions. This allows the macrospace to be loaded and saved from file. Any functions loaded into the macrospace are always in memory and this provides faster performance for these critical programs.

REXX Variable Pool - provides a function for the enumeration of all variables in the REXX variables pool. This provides a very powerful, runtime mechanism to implement debugging and other inspection of the REXX environment.

Stem Management - Standard, simple stem variables can be quickly sorted and copied using these functions.

Global Variables - Simple variables and stem variables of arbitrary complexity can be copied to and from system global memory. This is a kind of REXX specific interprocess communication, as any REXX program can publish and subscribe variables to shared memory. These variables can be of an arbitrary format, allowing any number of REXX programs to simultaneously access the same data.

Threading - A full set of threading related APIs is available. All REXX programs can be easily made multithreaded.

Inter-Process Communications - REXX programs have always have REXX queues for IPC support. However, there are many times when this is not sufficient. This is often the case when integrating with non-REXX applications or systems. RXMISC provides a full set of APIs allowing REXX programs to take advantage of Named Pipes (includes both server and client oriented APIs), Event Semaphores, Mutex Semaphores and Dynamic Data Exchange (DDE).

Process Management - A full set of interfaces to the system's process management APIs is available. There are interfaces for the starting (with the full set of operating system launching options such as specifying a custom environment) and stopping of processes. All processes in the system can be listed and thread-level details of each one are available. This is more than a full replacement for "PSTAT". Thread priorities can be modified.

Power Management - Provides full access and control of the APM subsystem. This includes query and control of standby, suspend, poweroff, resume on ring, resume on timer, AC power status, battery status, battery time remaining and battery charge %. A full, traditional system shutdown is also available.

System Query - Possibly the most interesting and powerful set of APIs in RXMISC, the System Query functions provide a very deep view into the operational state of the OS/2 system, with all information directly available and easily obtained by REXX programs. The following interfaces are included:

CPU Utilization - A summary by CPU (supports SMP) of system, interrupt and user time is available. Additional functions provide full details by process and thread of system and user time. (interrupt time is by definition, outside the context of a specific process).

Memory Utilization - A full memory utilization API is provided.   This API replicates the entire functionality of the IBM Theseus product, except it is 100% available via an API. The current Theseus product provides a subset of information via a mostly undocumented API. However a great deal of information is unavailable through the Theseus API. This is no longer an inhibitor! All of the Theseus reports can be accessed including system and per process reports. Please note that this function is only 75% complete and its completion is still in progress at the time of this writing.

Files - Lists all open files on the system and their core attributes such as number of times opened, size, SFN, access modes, sharing modes and flags.

Disks - Detailed information about both logical and physical disks is available. From drive letter, file system type and volume to sector information, free space and drive capacity are all available for every logical drive. For physical drives, even more information is provided. Examples includes serial numbers, firmware levels, capabilities, physical formatting characteristics and read/write and error statistics. A RAID API provides a detailed interface to IBM's ServeRAID hardware.

Hardware Inventory - Detailed APIs provide a full breakdown on the PCI bus, all data available from the SMBIOS, IBM's Vital Product Data (VPD), USB devices, the OS/2 resource manager and more. A complete superset of the Netfinity/SystemView System Information Tool is provided. This allows a very detailed inventory of every client and server system to be programmatically generated and maintained.

Other Operating System Resources - Modules, Semaphores, Shared Memory can all be queried in detail. Usage and statistics can be tracked back to each process.

Static Operation System Variables - OS/2 exports a wide range variables to allow applications to query basic system information. Examples include OS version, number of sessions, screen width and size and much more.

SysLevel File Access - Provides a full set of APIs for reading and writing the IBM "SysLevel" file format.

Window and Shell Management - The PM is a complicated environment, with unique integration requirements. While RXMISC doe not provide a REXX based GUI environment , it does allow extensive inspection, integration and manipulation of PM applications from REXX. See the following high level list:

- Window Enumeration and Details
- Task List Control
- Program Launching
- PM Message Post/Send
- System Shutdown
- WPS Restart and Status Query
- PM Message Boxes
- Menu and Button Query and Execution
- Clipboard
- Dynamic Data Exchange

RXIP

RXIP is a library of TCP/IP APIs that allow a REXX program to fully participate on a TCP/IP network as either a client or server. This includes both low level interfaces such as ICMP or sockets and application level interfaces such as Telnet or HTTP. In addition a powerful set of statistics can be queried on an ad hoc basis.

Domain Name System (DNS) - Complete, simple name resolution client. Can do both forward or reverse lookups.
File Transfer Protocol (FTP) - A full FTP client.
Internet Control Message Protocol (ICMP) - Provides functions for both PING and TRACERTE.
Message - Structured MIME message handling, SMTP send, BASE64 encoding/decoding .
Post Office Protocol (POP3) - Manage email inboxes using REXX.
Remote Execution Protocol (REXEC) - Execute commands on a remote host.
Simple Network Management Protocol (SNMP) - Provide a powerful interface to SNMP including supports for Get, GetNext, GetBulk, Set and Inform commands.
Sockets - A complete sockets interface, suitable for both clients or servers.
TCP/IP Statistics - NETSTAT API's including full details on send, receive and errors. Also includes listings of open sockets.
Telnet - Provides a full telnet client from REXX.
Web - Full HTTP access including Get, Head, Put, Post and Delete.

RXPRT

RXPRT is a completely unique solution for OS/2. It can be thought of as 3 related sets of APIs: OS/2 Printer Setup, OS/2 Spooler Management and Lexmark Printer Management. While point solutions exist to provide some level of all of these functions, only RXPRT provides an end-to-end set of APIs to address the entire range of printer related problems. It handles every aspect of printing from the OS/2 environment through the remote printer hardware (Lexmark printers only at this time). It is a complete, integrated replacement for such technologies as RINSTPRN and Lexmark's MarkVision. This library is MarkVision compatible and is the result of a licensing agreement by which Golden Code is able to utilize Lexmark's private APIs. When used properly, it can handle Lexmark printers in a manner compatible with and comparable to Lexmark's MarkVision.

RXPRT allows the complete, unattended and automated management and control of the entire printing environment of an enterprise. It is currently in production, managing many thousands of printers for a large enterprise client. There is no other solution that provides this capability, it is a very unique value.

OS/2 Printer Device Management and Configuration

With the following sets of APIs, a complete OS/2 printing environment can be created, queried, modified, deleted and completely controlled through REXX. No complicated and fragile response files are necessary (e.g. RINSTPRN). No manual effort is required. All aspects of the OS/2 printing setup can be automated drivers to queues, ports and devices.

Print Driver Control - Create, delete, list, modify as well as query and set all driver properties.

System Print Queue Control - Create, delete, list, modify as well as query and set all queue properties. There are also APIs to hold and release specific queues.

System Printer Port Control - Create, delete, list, modify as well as query and set all exposed (by OS/2) port driver properties. There is also an interface to query and control the port's associated protocol converter and status.

Print Device Control - Create, delete, list, modify as well as query and set device properties.

OS/2 Spooler Management and Configuration

While highly related to the OS/2 printer subsystem setup and control, the spooler must also be managed.

System Spooler Information and Control - Allows the spooler's status to be queried and controlled. For examples, the spooler can be enabled or disabled via this set of APIs. Allows status to be queried and will also report on the spooler's version.

Print Job Control - Provides a job-level interface for query and control. This set of APIs allows the list of jobs to be queried. Each job can be copied, deleted, moved to a different queue, held or released. Priority, queue position and even the spooler job properties can be modified. A helper function is provided to delete all jobs.

Lexmark Printer Management

Printer Information - All manner of information regarding the printer engine can be queried. This includes detailed capabilities, bidirectional support, fonts, input bins, output bins, jobs completed, jobs queued and status.

Print Server Information and Control - All network printers are connected by a "print server". This is an intelligent device that provides the LAN interface (Ethernet or Token-Ring), the printer connection (direct for internal print servers and via parallel or serial cable for external print servers) and a firmware driven processor that acts as a "bridge" between the network and the printer. These devices must be managed separately from

the printer engine itself. RXPRT provides the ability to enumerate all print servers on the network, query its detailed physical inventory, query its firmware environment, query and set the configuration and flash the firmware to a new level.   Examples of print server settings include its IP addresses information and the protocols that the print server has activated.

Printer Settings - Query and set all printer engine settings. There is no other tool in existence (at least on OS/2) that provides this capability (even MarkVision doesn't provide this). For the first time it is possible to completely control every printer's settings across the enterprise, on an automated basis. Examples of settings include font options, tray options, paper handling and much more.

Remote Printer Control - RXPRT provides a full implementation of a remote printer operator panel. This is the "last resort" for ad hoc printer management, allowing general purpose interactive access to the remote printer's buttons and menus. It can also provide a "scripted" way to query and control the printer through its buttons and menus, rather than through the architected settings interface. The settings interface is recommended.

Printer Job Management - Jobs can be listed, details of each job can be queried, specific jobs can be deleted and (if the printer supports it) undeleted.

Development Plans

Golden Code Development has the following plans for ongoing development of the REXX libraries. These plans are subject to change without notice.

RXMISC

- The memory utilization and inspection interfaces (e.g. like IBM's Theseus) are being finished. See below.
- A full, detailed logical and physical disk utilization API will be provided.
- A complete, binary-compatible REXXUTIL API will be added. This will allow RXMISC to be used as a drop-in replacement for REXXUTIL.
- A "C" language API will be provided for REXX QUEUE interaction
- XML parsing APIs
- CRC and checksum calculation APIs
- Encryption/Decryption/Digital Signature APIs

RXIP

- LDAP APIs
- Additional SNMP Utilities (trap agent, MIB management).
- SSL
- HTTPS

RXPRT

- No functional enhancements are being planned at this time (it is complete).
- New hardware support will be added at client's requests.

Generally, both the RXMISC and RXIP libraries will be ported to both the Linux and WIN32 platforms. If possible, the RXPRT library will also be ported to Linux and WIN32, however there are licensing issues that have yet to be resolved. All of the porting work will start in 2003.

Optionally, Golden Code would be willing port these libraries to Solaris, AIX and other platforms on request by clients.

Pricing

Development licenses are available at no charge.

Deployment licenses are aggressively discounted. Each library can be purchased separately based on the total number of systems on which it must be installed. In volume each library will range in price from a high of $15 per system (500 systems) to a low of $1 per system (50,000 systems). The entire suite of libraries can be purchased together and in this case additional discounts will be made available.

Please note that single unit and/or low volume pricing has not been determined, but requests will be taken on a case by case basis.

Availability

These libraries are in production on many tens of thousands of systems. The libraries are available for immediate purchase.

The only functions listed in the Product Description section above which are not 100% available are the memory utilization functions (e.g. the "IBM Theseus" capability). These are 75% complete and are in progress of being completed. Any client requiring these functions should specifically note this when opening discussions with Golden Code. Early access to this function can be provided or the delivery time can be accelerated according to the client's requirements.

About Golden Code Development

As a consulting firm and independent software developer, Golden Code Development Corporation helps its clients design, build, and manage mission critical, networked computing environments. The company specializes in technologies and techniques which enable the creation of enterprise-class systems with exceptionally low cost of ownership. Golden Code's core competencies include OS/2, Java, and Server-Managed Client solutions, such as IBM's WorkSpace On-Demand. Its expertise in these areas, combined with a disciplined design and implementation methodology, make Golden Code an ideal technology partner for the enterprise customer.

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