

# IBM i 7.3 Technology Refresh 9 offers significant enhancements to many areas of the integrated operating system

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## Overview

IBM<sup>®</sup> i delivers the next Technology Refresh (TR) for IBM i 7.3. This refresh, TR9, provides a plethora of functions across many of the products in the IBM i portfolio. Many of the updates to the portfolio have been directly influenced by input from clients, partners, and application providers, using both the Request for Enhancement (RFE) process and direct feedback. IBM i is providing a "Clear Vision for the Future" by delivering this latest set of functions.

IBM i 7.3 TR9 follows the tradition of previous technology refreshes. There are a wide variety of enhancements, updates, and additions across the entire portfolio of products. These are focused on many areas including performance, management, deployment, and ease-of-use.

### Base operating system

- The enhancements in the web-based IBM Navigator provide better monitoring capabilities for system administrators, allowing them to react faster and with better insight.
- IBM Integrated Web Services Server is updated to include both the ability to directly specify a user registry that may be used for authentication for the IWS request and ability to integrate with a third-party security service by using trust association interceptors (TAI). Support for TLSv1.3 is also included with the Integrated Web Services Client.
- IBM i cluster technologies include enhancements to help system administrators manage environments which use independent auxiliary storage pools (IASPs), cluster administrative domain, or geographic mirroring.

### Db2<sup>®</sup> for i

- Db2 for i is extending the SQL DROP command to include the IFEXISTS clause and the SELECTIVITY clause is added to the SQL query predicates, providing improved performance for SQL queries.
- Many additional IBM i services are included in this refresh. Leveraging the power of SQL and Db2 for i SQL Query Engine (SQE), application developers, database engineers, and system managers gain the ability to explore IBM i objects and data in ways that were not possible previously.

### Open Source

- The Open Source portfolio of products available for IBM i is growing significantly in this refresh. These enhancements include compression tools, command line utilities, open source databases, and Node.js updates. These additions to the

portfolio mean that many more applications can run natively on IBM i and many Open Source developers may take advantage of standard industry tools available now on IBM i.

- Ansible<sup>(R)</sup> provides an interesting set of capabilities for IBM i in both system administration and application deployment environments. The IBM i team provides a rich set of action plugins, roles, and sample playbooks to automate many tasks on IBM i.
- Key interfaces in the IBM i ToolBox for Java<sup>TM</sup> are updated and improved to ensure that Java developers have access to the latest IBM i technologies.

### Licensed program products

- IBM Backup, Recovery, and Media Services (BRMS) is including a variety of enhancements focused on satisfying many requests for improvements, including easier to use reporting of processes to help make information more readily available. Additionally, BRMS is incorporating some IBM i services to improve usability.
- IBM PowerHA<sup>(R)</sup> SystemMirror<sup>(R)</sup> for i is releasing improvements in simplifying deployment and management of high-availability environments. These are focused around the reduction in the number of commands required to manage and deploy PowerHA, the addition of dashboards and IBM i Services for ease-of-use, and the consolidation of information onto fewer screens, making it easier to watch impacts to the systems and make required adjustments.
- IBM Cloud<sup>(R)</sup> Storage Solutions for i expands the list of supported storage environments, including the use of proxy servers.
- IBM Administrative Runtime Expert is streamlining the management of deploying and applying PTFs across a diverse set of systems.
- The RPG compiler, included in Rational<sup>(R)</sup> Development Studio, includes enhancements when working with exported procedures and additional parameters available in Control Specifications and compile commands. There is an additional set of built-in functions supported in this refresh.
- Rational Developer for i 9.6.0.8 contains many features to assist in the processes of refactoring and modernizing application code.

### Hardware and firmware

- IBM i initial program load (IPL) time is improved.
- IBM i supports faster duplication of tape media in the case where the files to be duplicated are not at the beginning of the media.
- IBM i supports the hardware, firmware, virtualization, and I/O that are announced for delivery later this year, providing operational efficiency and increased configuration flexibility.

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## Key requirements

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IBM i 7.3 TR9 is supported on selected IBM Power<sup>(R)</sup> Systems servers with:

- IBM POWER9<sup>TM</sup> technology-based processors
- IBM POWER8<sup>(R)</sup> technology-based processors
- IBM POWER7<sup>(R)</sup> or IBM POWER7 + processors

Clients using blades or IBM PureFlex<sup>(R)</sup> systems, and those using servers with IBM POWER6, IBM POWER6+, or earlier processors, need to move to newer systems to take advantage of the features in IBM i 7.3 TR9.

For up-to-date information on all types of code levels needed for support of a particular feature, see the [IBM Prerequisite](#) website.

See the [Technical information](#) section for specific hardware and software prerequisites.

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## Planned availability date

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November 13, 2020

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## Description

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IBM i 7.3 TR9 offers clients additional features and enhancements across many of the components in the IBM i portfolio of products. As in previous updates, the enhancements are delivered through a set of PTFs and PTF groups and provide significant improvements for developers and administrators.

Technical details for IBM i enhancements delivered with IBM i 7.3 TR9 can be found at the [IBM i Technology Updates](#) wiki.

To make it easy to find IBM i 7.3 TR9-specific enhancements, see the aggregated list of enhancements found on the [IBM i 7.3 TR9](#) wiki landing page.

### **IBM i Operating System (5770-SS1)**

The IBM i Base Operating System is comprised of many pieces skillfully interwoven to provide a comprehensive, integrated operating system, including a relational database, a workload manager, security monitor, and many more components. Every technology refresh includes changes to many of the components of the Base Operating System.

### ***IBM Navigator for i***

The enhancements in the web-based Navigator provide better monitoring capabilities for system administrators, allowing them to react faster and with better insight.

#### *Performance Data Investigator (PDI)*

The recently delivered modern PDI visualization has been improved to provide more complete information to system administrators trying to understand IBM i performance. A new chart interface has been added to many PDI functions. Some of them are listed below:

- Launching the system monitor single metric opens the chart interface by default
- Job Wait Interval details panel
- Updated dojo tables include filter, column ordering, row selection navigation, and more
- Timeline chart
- Pie chart
- QAPMCONF panel
- Multicollection support so that multiple performance collections can be viewed in a single visualization
- Points selection navigation support in dojo chart

#### *System Monitor*

Previously, the interface for Navigator contained a system monitoring component which monitored many system metrics, as well as specifying actions to be taken when various thresholds were reached.

To improve the management of these monitors, users included in the QINAVMNTR and QPMCCFCN authority lists are able to manage all monitors on IBM i, not just the ones created by that specific user.

## ***Integrated Web Services (IWS) Server***

IWS Server provides an easy-to-use, robust environment for creating and hosting REST or SOAP APIs. This is an easy way to expose key ILE programs, service programs, and wrapped well-formed SQL as REST APIs.

This TR provides additional capabilities for the IWS environment:

- Ability to directly specify a user registry that may be used for authentication for the IWS request.
- Ability to configure IWS server to integrate with a third-party security service by using TAI. The TAI is a service provider API that enables the integration of third-party security services with an IWS server. When processing the web request, the IWS server calls out and passes the `HttpServletRequest` and `HttpServletResponse` to the trust association interceptors. This support also enables the use of JSON Web Tokens for Authentication.

The Integrated Web Services Client for ILE provides an easy way to consume SOAP and REST services. The latest update includes support for Transport Layer Security version 1.3 (TLSv1.3) protocol.

Details about the latest support can be found on the [Integrated Web Services for IBM i - Web services made easy](#) web page.

## ***Clustering and IASP enhancements***

IBM i delivers three enhancements to reduce complexity for a system administrator. The first adds the ability to specify a port number for geographic mirroring. The second provides the capability of automatically waiting to retry a cluster node activation after IPL completes. The third adds detection of duplicate IFS directory names to Independent ASP Vary On processing.

Previously, when necessary to acquire a port for connection, geographic mirroring would use a random port number. This could cause problems for system administrators when implementing Quality of Service (QoS) and security for their environment. Support has been added to the `WRKSRVTBLE` (Work with Service Table Entries) command to allow the specification of a particular port number for use by geographic mirroring.

There has been a timing window when system administrators try to start a cluster node in their start-up program after an IPL, but the IP addresses specified for the cluster node are not yet fully activated. This situation will cause the cluster node to fail to start. The system administrator will be required to attempt the start of the cluster node again at a later time. An enhancement has been made to allow an automatic retry to start the cluster node after waiting for a period of time for the IP addresses to become fully active so that the start will be successful.

Prior to this technology refresh, if there was an IFS directory in SYSBAS and there was a vary on of an IASP whose name was the same as that IFS directory, the result was that the vary on of the IASP would complete successfully, but the IFS directory in the IASP was not visible or accessible to anyone. The recommended work-around (vary off the IASP, delete, or rename the existing IFS directory in SYSBAS, and vary on the IASP again) could take a lot of time, and the user may not have been aware of the recommended action to take to correct the situation. IBM i 7.4 TR3 adds an enhancement that detects the presence of an IFS directory in SYSBAS with the same name as the IASP during the IASP vary on process. The system administrator is notified about the situation through an inquiry message so that appropriate action can be taken, such as renaming, moving, or deleting the existing IFS directory in SYSBAS, or forcing a "mount" of the IFS directory in the IASP over the IFS directory in SYSBAS.

## ***Electronic Service Agent (ESA)***

The ESA support has been updated to give IBM i system administrators the flexibility to allow ESA jobs to be scheduled with a choice of scheduling options. ESA is

installed as a component of the IBM i operating system. For more details and PTF information, see [Manually creating ESA job schedulers](#) page.

### **Updated machine interface (MI) instruction**

The GENUUID instruction has been enhanced to generate a version 4 Universally Unique Identifier (UUID), which is a randomly generated UUID that is consistent with the Internet Engineering Task Force (IETF) specification as described in [RFC 4122](#). See the [GENUUID MI Instruction](#) topic in IBM Knowledge Center for more information. PTF MF67674 provides this support.

### **IBM Db2 for i**

The integrated database for IBM i, Db2 for i, is known for containing the attributes valued by business computing solutions. In IBM i 7.3 TR9, Db2 for i is enhanced to include new and improved SQL capabilities, both in the language itself and by using SQL as the foundation for new IBM i Services.

#### **Db2 for i enhancements**

With this update, Db2 for i continues to focus on new and advanced SQL capabilities and the ability to use SQL for accessing details of the IBM i operating system. SQL Application developers will see some ease of use programming enhancements, and database engineers will recognize that the new and improved SQL services will allow better management of the database.

- The DROP statement is enhanced to support the IF EXISTS clause, streamlining Database Definition Language (DDL) processing.
- The SELECTIVITY clause is added to SQL query predicates, allowing the database performance expert to better influence the SQL Query Engine plan choice.
- The RELATED\_OBJECTS SQL service is added to provide deep details regarding dependencies over a database file.

These enhancements and others are delivered through the Db2 PTF Group.

For additional information, see the database section of the [IBM Db2 for i - Technology Updates](#) wiki page to learn more about all of the Db2 for IBM i enhancements included in IBM i 7.3 TR9.

### **IBM i Services**

The number of IBM i Services, considered to be the strategic method for gaining access to IBM i objects, system information, and more, continues to grow. Leveraging the power of SQL and the Db2 for i SQL Query Engine (SQE), application developers, database engineers, and system managers are able to explore IBM i objects and data in ways that were not possible with previous technologies.

In the tradition of recent technology refreshes, IBM i Services are added and enhanced, providing useful SQL-based alternatives to IBM i commands and APIs.

- SERVER\_SHARE\_INFO - Provides an SQL solution to extract the details about IBM i NetServer shares, opening up many systems and security management use cases to the SQL user.
- DISPLAY\_JOURNAL - The ever-popular table function is enhanced to improve performance, ease of use, and coverage for SYSLOG audit journal coverage.
- IFS\_READ and IFS\_WRITE - Procedures and functions are added to allow the SQL programmer to easily construct or consume the contents of an IFS stream file.
- SOFTWARE\_PRODUCT\_INFO - An SQL alternative to the Display Software Resources (DSPSFWRSC) command is added, providing an easy programming alternative to solution providers.
- DATA\_QUEUE\_ENTRIES - SQL support for data queues is extended to include a service that can query one or more of the messages residing on a data queue.
- DB\_TRANSACTION\_INFO - The database transaction information is extended to include database record lock holder detection, giving the system administrator a technique for quiescing system activity.

- EXIT\_POINT\_INFO and EXIT\_PROGRAM\_INFO - Discovering and managing exit points and exit point programs is available using this SQL alternative.
- WATCH\_INFO and WATCH\_DETAIL - These enhancements make it possible and easy to discover and manage system watches.
- JOURNALED\_OBJECTS - To discover which objects are using a specific journal, this service can be used to probe directly into that journal.
- LIBRARY\_INFO - The information available using this IBM i Service is enhanced to provide a high-performance query option and to include return columns with more contextual detail about the library.
- COMMUNICATIONS\_ENTRY\_INFO - This IBM i Service is being extended to allow SQL users to access the final piece of subsystem definition detail.
- SYSTEM\_STATUS\_INFO - The strategic alternative to the Work with System Status (WRKSYSSTS) command is enhanced again to include more return columns describing critical detail about the IBM i.
- OPEN\_FILES - To discover both the existence of an open file and details related to the open files in the target job, this IBM i service can probe into an active job.
- SYSLIMITS\_BASIC - This IBM i service provides a fast-performing approach alternative to SYSLIMITS, for studying System Limits historical detail.
- There are additional enhancements to IBM i Services.

For details about these enhancements and the other [IBM i Services](#) enhancements, see the [IBM i Technology Updates wiki](#) for complete details.

### **Open Source for IBM i**

The open source ecosystem continues to grow, with particular emphasis on the RPM-based set of deliveries. These enhancements include compression tools, command line utilities, open source databases, and Node.js updates. To get started with RPMs, see the [IBM i RPM Open Source](#) repository.

#### ***p7zip***

p7zip is a port of the command-line version of 7-Zip to Unix-like POSIX systems. It can work with various file formats including 7-Zip archives (those ending with .7z). For more information, see the [P7ZIP Sourceforge](#) webpage.

#### ***zstd***

zstd (or Zstandard) is a newer compression library from Facebook. It is designed for real-time activities. By design it prioritizes the speed of compression/decompression operations. For more information, see the [Zstandard](#) webpage.

#### ***pigz***

pigz is a parallelized version of gzip. It can take advantage of multiple CPU cores to speed up compression over standard gzip. For more information, see the [pigz](#) home page.

#### ***Curl with SSH and SFTP support***

Curl has been upgraded to 7.70.0 and was also built with the newly released libssh2. This allows it to use ssh:// and sftp:// URLs.

#### ***"man page" viewer***

The 'man' command is available through delivery of the 'man-db' package. This allows the viewing of reference manuals, often called "man pages", for many of the packages delivered as RPMs.

#### ***Autossh***

The autossh package provides a tool for keeping SSH tunnels open. As an example, it will automatically restart the tunnel should it crash. For more information, see the [autossh - Automatic SSH restart](#) webpage.

## ***Tmux***

A popular terminal multiplexer, tmux, is now available. It allows the creation of multiple SSH terminal sessions that are persistent, meaning they can reconnect and resume work, even if a disconnect has happened due to a network outage or some other unpredicted event. It also enables multiple windows within a specific session. For more information, see the [tmux github](#) wiki page.

## ***Paramiko***

The Python Paramiko package is available in RPM form. Paramiko makes it easy to use SSH, SCP, and SFTP from within Python. It provides a powerful and highly automatable way to use SSH/SFTP as part of business procedures, such as pushing or pulling data and running commands. It also provides an easy way to make remote XMLSERVICE calls (especially to IBM i instances in IBM Cloud) using SSH and xmlservice-cli (part of the 'itoolkit-utils' package). For more information, see the [Paramiko](#) website.

## ***Chsh***

The ability to customize which shell is used for SSH sessions has existed for some time through an SQL service. With the chsh RPM package, it is even easier. For example, it is simple to run 'chsh -s /QOpenSys/pkgs/bin/bash' to set the default shell to bash.

## ***Logrotate***

The logrotate tool can be used to automatically rotate, compress, and even remove log files. This is very useful for log files that could grow very large if left unchecked. While the HTTP Server for i supports this with log cycling, not all products have this capability built in. Therefore, this type of specialized tool can prove very valuable for managing both file size and manipulation.

It is very configurable, allowing the customizing of the name format of archived logs, specifying how many logs to keep, or whether the archived logs should be compressed. Note that this is not a service that runs continuously. Instead, it must be run periodically or through the job scheduler. Once running, it will analyze all the log files for which it is configured and rotate the files as needed. For more information, see the [Logrotate -Linux<sup>®</sup>](#) home page.

## ***PostgreSQL 12***

PostgreSQL is an open-source object-relational database system. In order to ensure the security and scalability of business data, PostgreSQL not only uses but extends the SQL language with additional features. PostgreSQL has earned a strong reputation for its proven architecture, reliability, data integrity, robust feature set, extensibility, and the dedication of the open-source community behind the software to consistently deliver performant and innovative solutions. For more information, see the [PostgreSQL](#) home page.

For more instructions, see the [Install and configure Postgresql DB Server on IBM i](#) wiki page.

## ***MariaDB***

The MariaDB open source relational database is a drop-in replacement for MySQL. It is one of the most popular open-source databases in the world, and is the default database for numerous turnkey applications, especially in the PHP ecosystem. Bringing MariaDB to IBM i enables the use of many of these business application solutions on IBM i. For more information, see the [MariaDB](#) home page.

## ***GNU Privacy Guard***

GNU Privacy Guard, also referred to as GnuPG or GPG, is an open source implementation of the OpenPGP standard. It uses public key cryptography for

signing and encryption. For more information, see the [GNU Privacy Guard \(GPG\)](#) home page.

### ***Node.js version 14***

The latest release of Node.js that will be on a long-term support schedule is now available. This release has numerous improvements in performance, security, and diagnostics. For more information about the Node.js release schedule, see the [Nodejs GitHub](#) wiki page.

### ***Ansible support for IBM i***

Ansible provides an industry-standard solution for automating tasks across the compute estate. The IBM i team provides a rich set of action plug-ins, roles, and sample playbooks to automate many tasks on IBM i. This includes automation for fix management, application deployment, security management, and many other IBM i administrative tasks.

Details about Ansible support for IBM i can be found at the [Ansible Content for IBM Power Systems -IBM i GitHub](#) wiki page.

### ***IBM Toolbox for Java***

IBM Toolbox for Java contains native Java methods for accessing, updating, and interacting with objects and interfaces on IBM i. These key interfaces continue to be updated and improved to ensure that the Java developer has access to the latest IBM i technologies. Some of the enhancements added in this TR include:

- IFS performance improvement when retrieving attributes for directories, files, and symbol links.
- Support for converting varchar to bytes. When using `AS400Text.toByte()`, the program receives the string without the first two characters because the first two bytes of a varchar are the length of string. The support for varchar in Java toolbox is added.
- IFS User Handle 2 provides single sign-on support to retrieve attributes of IFS files using Kerberos-based authentication.

### **Licensed Program Products (LPPs)**

The IBM i Portfolio of LPPs provide a significant number of technologies to IBM i clients. These program products include tools for application development, high availability, mobile access, and more. This TR includes enhancements to those LPPs.

### ***Backup, Recovery and Media Services for i (5770-BR1)***

In this TR, BRMS for i has added many requested enhancements, including:

- The `PRTRPTBRM` command using parameter `TYPE(*CTLGRPSTAT)` delivers two enhancements:
  - The `EXPDATE` parameter allows reporting of active control group data.
  - The report shows if encryption was used during the backup of any control group entries.
- BRMS has changed the sync job for maintenance with the Reorganize BRMS database parameter `RGZBRMDB(*YES)` to reduce the amount of time there are locks on the network related files. This will help to prevent locks during maintenance.
- The following values for \*LNK Backup Control Group Entries on the Save While Active attribute have been added: `*ALWCKWR`, `*ALWCKSY`, `*LNKALL`, `*LNKALLS`.
- Changes were made in the BRMS Recovery Report (QP1ARCY) to streamline the required recovery steps.
- BRMS enhanced the Backup Control Group processing of an empty `*OUTQ`.
- Some SQL services are now included in BRMS which provide a similar view of media information provided by the `WRKMEDBRM` command.
- A move policy location for full volumes has been added.



- The WRKOBJBRM command has been enhanced with the START parameter to order which entries are shown first.

The preceding list of enhancements to BRMS are added in IBM i 7.3 PTF SI73677.

### ***IBM PowerHA SystemMirror for i (5770-HAS)***

IBM PowerHA SystemMirror for i (PowerHA) 7.2 enhancements (included in HA fix pack 3.5), delivers a set of enhancements centered around deployment and usability that simplify the management of high availability environments.

#### *Simplified deployment*

Deploying a PowerHA cluster has been greatly simplified in this release with automation and default settings that can be customized. The number of manual steps required to configure a PowerHA environment have been significantly reduced, enabling a quicker and simpler setup.

#### *Simplified management*

Simplifying the management of PowerHA, commands have been made easier to use by providing additional prompt support. For example, there are Contextual F4 prompt options and prompting that are optimized to pertain to the specific environment and configuration.

#### *PowerHA dashboards*

By design, PowerHA requires minimal ongoing monitoring, management, and maintenance. The updated PowerHA dashboards make the monitoring even simpler. At-a-glance views using the dashboards enable administrators to see any errors or warnings that may affect their business continuity. These dashboards can be configured to have one screen display multiple PowerHA environments alongside information from other availability products as well. This significantly improves the simplicity of managing multiple implementations.

#### *Geographic Mirroring Real-time recovery point objective (RPO) information*

A key metric for a business continuity solution, the RPO indicates how much data will be lost in the event of a disaster.

For synchronous solutions such as PowerHA synchronous geographic mirroring, the RPO is 0. However, synchronous solutions are limited to a maximum distance of approximately 300 kilometers. PowerHA enables replication to span the globe with asynchronous geographic mirroring. As with any asynchronous solution, the trade-off for greater distances is a larger RPO.

With this latest update to PowerHA, regardless whether the delivery is synchronous or asynchronous, real-time RPO information is displayed on the geographic mirroring session screen. This information assists administrators by estimating the impact of the network on the performance of geographic mirroring.

#### *PowerHA SQL services*

PowerHA introduced support for SQL services earlier this year. This update expands this support to include SQL-based access for PowerHA session information, enabling clients to query information about the state of replication.

#### *Additional enhancements*

There are several other enhancements to PowerHA including easier to configure firewall security and QoS in a geographic mirroring environment with the ability to specify a port number for use by geographic mirroring.

For more information about these enhancements, see the [IBM PowerHA SystemMirror for i](#) wiki page.

The planned availability date for the update to IBM PowerHA SystemMirror for i is December 18, 2020.

### **IBM Cloud Storage Solutions for i (5733-ICC)**

IBM Cloud Storage Solutions provides an API interface for moving IBM i data to storage based in a cloud environment. It has tight integration with BRMS allowing for automated IBM i backup to cloud-based storage. The list of supported cloud storage systems has been enhanced to include Google Cloud storage using an S3 connection. Additionally, IBM Cloud Storage Solutions can support leveraging a proxy server when running in a pure cloud-based infrastructure.

### **Administration Runtime Expert (ARE)**

ARE is adding support to meet the needs of administrators looking for a solution to maintain, distribute, and apply PTFs to multiple IBM i partitions. The PTF support is enhanced to make the management of diverse PTF apply requirements easier to use. The reporting capabilities have been updated to provide more information about all systems in the ARE environment.

### **Rational Development Studio (5770-WDS)**

In this TR, IBM i delivers additional capabilities in the RPG language, part of Rational Development Studio for i. Many of these requirements have been requested from the IBM i developer community providing ease of use, easier integration, and other enhancements. Some of the updates include:

- Parameter REQEXTPR is added to the CRTBNDRPG and CRTRPGMOD commands to control how the compiler responds when there is no prototype specified for an exported procedure. Additionally, the keyword REQEXTPR can be placed in the Control Specification (H-spec). The default for the LEVEL parameter is \*NO. With the \*WARN level, the compiler will issue a warning diagnostic message. With the \*REQUIRE level, the compiler will issue a severe diagnostic message causing the compile to fail.
- With keyword EXPROPTS(\*ALWBLANKNUM), a value of blanks will not cause an error %INT, %INTH, %UNS, %UNSH, %DEC, %DECH, and %FLOAT. The built-in function will return the value zero. A blank value will also be allowed for a numeric value for XML-INTO and DATA-INTO.
- With control keyword EXPROPTS(\*USEDECEDIT), %DEC and %DECH will accept "thousands" separators in a string operand. Thousands separators are used when separating decimal characters into thousands, for example the comma is the thousands character in 1,000,000. The decimal point and thousands separator specified by the DECEDIT keyword will be used to interpret the string.
- Built-in functions %LIST and %RANGE, and 'IN' operator:
  - %LIST allows specification of an array directly in calculations. %LIST can be used wherever an array can be used, with a few exceptions such as SORTA and %LOOKUP.
  - The IN operator with %RANGE allows checking whether a value is in a range of values or whether the value is in an array or list.
- When control keyword DEBUG(\*RETVAL) is specified, the value being returned by a subprocedure can be determined within the debugger by evaluating the special variable \_QRNU\_RETVAL.

For more information about details and updates, see the [RPG Cafe](#) website.

### **IBM Rational Developer for i (RDi 9.6.0.8) (5733-RDW) (D0C5FLL/DOZN3LL in Passport Advantage<sup>(R)</sup>)**

RDi is the strategic tool for RPG and COBOL development and is used by IBM i developers all over the world. These developers contribute suggestions and ideas to IBM. Many features have been added to assist in the process of refactoring and modernizing application code, including:

- The extract procedure refactoring feature can be used to convert business rules into reusable procedures.
- The library list view is enhanced to easily modify a library list from any RDi perspective.
- A simpler way to search for RDi preferences with the preferences keyword filter.
- Variables larger than 4,095 characters can be seen in the RDi debugger.
- Service entry points allow conditional entries for breakpoint.
- Persist display hover text for procedure parameters has been added.
- Double-clicking of source elements will allow the inclusion of the "\*" symbol when appropriate.
- Sorting by name control in the outline view will not affect the sorting of key fields.
- Additional features in the RDi editor to support functions in the RPG Language (see RDS section above):
  - DATA-GEN opcode is supported.
  - OPTIONS(\*EXACT) for prototyped parameters is added.
  - OVERLOAD keyword is supported in the editor.
- Editor navigation for marked occurrences of variables has been enabled.
- Many SQL formatter improvements.
- The improved "Copy To" dialog reduces the chances of a user copying to an unintended location.
- /copy and /include files can be opened from source stored on IFS.
- IBM i Access Client Solutions (ACS) can be launched from RDi without requiring a separate Java Runtime Environment installation.

For more information about these and many more enhancements, see the [IBM Rational Developer for i](#) fix list.

### ***IBM Universal Manageability Enablement for i***

The Common Information Model support that is part of 5770-UME has been updated to support TLS 1.3.

### **Hardware and firmware**

#### ***IBM i IPL time improvement***

IBM i initial program load (IPL) time has been reduced by optimizing main storage (memory) hardware configuration checking. The first IPL after installing the TR will take the usual amount of time. Subsequent IPLs may be faster depending on the amount of main storage. The larger the amount of main storage, the greater the potential for noticeable improvement in IPL time.

#### ***Increased speed for duplicating tape media***

IBM i now supports faster duplication of tape media in the case where the files to be duplicated are not at the beginning of the media. The commands whose processing times have been improved are DUPTAP and DUPMEDBRM.

With this enhancement, the duplicate tape function will space directly to the files to be duplicated instead of searching every file on the media to find the correct files to duplicate. This can also reduce media wear by limiting the number of full media passes needed to position to the files to be duplicated.

#### ***Power Systems support***

IBM i supports the latest hardware, firmware, virtualization, and I/O that provide operational efficiency and increased configuration flexibility:

- Power Systems server models 9009-22S and 9009-42S are tuned for SAP HANA workloads and can run IBM i workloads on the same server

- PCIe4 x8 NVMe Flash adapters
- PCIe2 2-Port USB 3.0 adapter
- PCIe3 16 Gb 2-port Fibre Channel adapter
- New level of VIOS that allows multiple mapping of NPIV ports for Live Partition Mobility (LPM) operations and improvements to NPIV scaling
- Mainstream 931 GB, 1.86 TB, 3.72 TB, and 7.44 TB capacity solid-state drives (SSDs)

In addition, the previous TR level supports the Power Systems server models 9009-41G, 9009-42G, and 9009-22G, which were announced on July 14, 2020. These models have 2.5" bays for NVMe devices and an increased number of PCIe gen4 slots. The 9009-22G includes a 1-core offering.

### ***Additional details***

Additional details about these and other hardware-related and firmware-related enhancements can be found in the [Hardware and Firmware](#) section of the Technology Updates wiki.

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## **Reference information**

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For additional information about IBM, see Software Announcement [220-382](#), dated October 6, 2020, IBM i 7.4 TR3.

For additional information about hardware, virtualization, and I/O, see:

- Hardware Announcement [120-025](#), dated July 14, 2020, IBM Power System S922 (9009-22G) and S922 Entry Level Single Socket
- Hardware Announcement [120-024](#), dated July 14, 2020, IBM Power System S924 (9009-42G) with Epic Solution Edition
- Hardware Announcement [120-026](#), dated July 14, 2020, IBM Power System S914 (9009-41G)
- Software Announcement [220-380](#), dated October 6, 2020, IBM Virtualization enhancements
- Hardware Announcement [120-055](#), dated October 6, 2020, IBM Power System H924 (9223-42S)
- Hardware Announcement [120-054](#), dated October 6, 2020, IBM Power System H922 (9223-22S)
- Hardware Announcement [120-064](#), dated October 6, 2020, IBM Power Systems enhancements

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## **Program number**

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<b>Program number</b>	<b>VRM</b>	<b>Program name</b>
5770-SS1	7.3	IBM i 7.3 TR9

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## **Offering Information**

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Product information is available on the [IBM Offering Information](#) website.

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## **Publications**

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None

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## **Services**

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## Software Services

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IBM Software Services has the breadth, depth, and reach to manage your services needs. You can leverage the deep technical skills of the lab-based software services team and the business consulting, project management, and infrastructure expertise of the IBM Global Services team. Also, IBM extends the reach of IBM Software Services through IBM Business Partners to provide an extensive portfolio of capabilities. IBM provides the global reach, intellectual capital, industry insight, and technology leadership to support a wide range of critical business needs.

To learn more about IBM Software Services, contact your Lab Services Sales or Delivery Leader.

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## Technical information

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### Specified operating environment

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#### **Hardware requirements**

IBM i 7.3 TR9 is supported on select Power Systems servers with POWER9, POWER8, POWER7 +, or POWER7 processors. Clients using blades or PureFlex systems, and those using servers with POWER6 or POWER6+ or earlier processors, need to move to newer systems to take advantage of the features in IBM i 7.3 TR9.

For up-to-date information about all types of code levels needed for support of a particular feature, see the [IBM Prerequisite](#) website.

For additional information, see the [System to IBM i maps](#) website.

#### **Software requirements**

To find the supporting technical details and software requirements for IBM i 7.3, see the [TR9 enhancements](#) website.

#### **IBM Support**

[IBM Support](#) is your gateway to technical support tools and resources that are designed to help you save time and simplify support. IBM Support can help you find answers to questions, download fixes, troubleshoot, submit and track problem cases, and build skills. Learn and stay informed about the transformation of IBM Support, including new tools, new processes, and new capabilities, by going to the [IBM Support Insider](#).

### Planning information

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#### **Packaging**

This offering is delivered through the internet and as physical media.

#### **Security, auditability, and control**

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IBM i uses the security and auditability features of IBM i.

The client is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communication facilities.

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## Ordering information

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Consult your IBM representative.

## **Charge metric**

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Not applicable.

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## **Terms and conditions**

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The information provided in this announcement letter is for reference and convenience purposes only. The terms and conditions that govern any transaction with IBM are contained in the applicable contract documents such as the IBM International Program License Agreement, IBM International Passport Advantage Agreement, and the IBM Agreement for Acquisition of Software Maintenance.

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### **License Information number**

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Follow-on releases, if any, may have updated terms. See the [License Information documents](#) website for more information.

### **Limited warranty applies**

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Yes

### **Limited warranty**

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IBM provides you with access to IBM databases containing information on known program defects, defect corrections, restrictions, and bypasses at no additional charge. For further information, see the [IBM Support Guide](#).

IBM will maintain this information for at least one year after the original licensee acquires the program (warranty period).

### **Program support**

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Subscription and Support includes telephone assistance, as well as access to updates, releases, and versions of the program as long as support is in effect. You will be notified of discontinuance of support with 12 months' notice.

### **Money-back guarantee**

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If for any reason you are dissatisfied with the program and you are the original licensee, you may obtain a refund of the amount you paid for it, if within 30 days of your invoice date you return the program and its PoE to the party from whom you obtained it. If you downloaded the program, you may contact the party from whom you acquired it for instructions on how to obtain the refund.

For clarification, note that for programs acquired under any of IBM's On/Off Capacity on Demand (On/Off CoD) software offerings, this term does not apply since these offerings apply to programs already acquired and in use by you.

### **Volume orders (IVO)**

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No

### **Passport Advantage applies**

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No

### **Usage restrictions**

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Yes

For usage restrictions, see the License Information documents listed in this [Terms and conditions](#) section.

### **Software Subscription and Support applies**

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Yes. All distributed software licenses include Software Subscription and Support (also referred to as Software Maintenance) for a period of 12 months from the date of acquisition, providing a streamlined way to acquire IBM software and assure technical support coverage for all licenses. Extending coverage for a total of three years from date of acquisition may be elected.

While your Software Subscription and Support is in effect, IBM provides you assistance for your routine, short duration installation and usage (how-to) questions, and code-related questions. IBM provides assistance by telephone and, if available, electronic access, only to your information systems (IS) technical support personnel during the normal business hours (published prime shift hours) of your IBM support center. (This assistance is not available to your end users.) IBM provides Severity 1 assistance 24 hours a day, every day of the year. For additional details, go to the [IBM Support Handbooks](#) page.

Software Subscription and Support does not include assistance for the design and development of applications, your use of programs in other than their specified operating environment, or failures caused by products for which IBM is not responsible under this agreement.

### **IBM Operational Support Services - SoftwareXcel**

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No

## **System i Software Maintenance applies**

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Yes

## **Variable charges apply**

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No

## **Educational allowance available**

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Yes. A 15% education allowance applies to qualified education institution clients.

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## **Statement of good security practices**

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IT system security involves protecting systems and information through intrusion prevention, detection, and response to improper access from within and outside your enterprise. Improper access can result in information being altered, destroyed, or misappropriated or can result in misuse of your systems to attack others. Without a comprehensive approach to security, no IT system or product should be considered completely secure and no single product or security measure can be completely effective in preventing improper access. IBM systems and products are designed to be part of a regulatory compliant, comprehensive security approach, which will necessarily involve additional operational procedures, and may require other systems, products, or services to be most effective.

**Important:** IBM does not warrant that any systems, products, or services are immune from, or will make your enterprise immune from, the malicious or illegal conduct of any party.

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## **Prices**

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There is no new prices information in this release.

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