High Performance Computing Cloud Offerings from IBM Technical Computing

IBM Redbooks Solution Guide

The extraordinary demands that engineering, scientific, and research organizations place upon big data analytics and high performance computing (HPC) infrastructures, and the difficulties that are associated with moving large volumes of data, has slowed the adoption of cloud computing in these environments. A common perception is that most existing cloud computing solutions are based on highly granular virtualization models that do not deliver the performance that is needed to solve HPC and data analytics problems. However, virtualization technology is evolving and many HPC and analytics workloads now perform well in virtualized environments. The key is to know which workloads perform well in a virtualized environment and which require a physical environment. Then, you can build a balanced solution that supports all workloads in a single shared environment.

Based on proven cluster, grid, analytics, and HPC cloud technology, IBM® cloud offerings are built on scalable, high performance platforms. They have intuitive and versatile user interfaces, robust “resource-aware” job scheduling, workload aware and user-driven provisioning, and powerful management capabilities to help ensure that departmental, enterprise, or community resources are optimally deployed, simple to use, and easy to manage. With IBM cloud offerings, you can be confident that you are getting the optimal performance and processing efficiency out of your hardware and software resources. Your organization gains greater access to computing and application resources, benefits from higher throughput for faster time to results, and improved administrator and user productivity. You can align resources with project priorities and realize improved operational and cost efficiencies while achieving business goals that might be unattainable with other cloud solutions.

Figure 1 shows some of the benefits that IBM Technical Computing Cloud offerings can offer you.

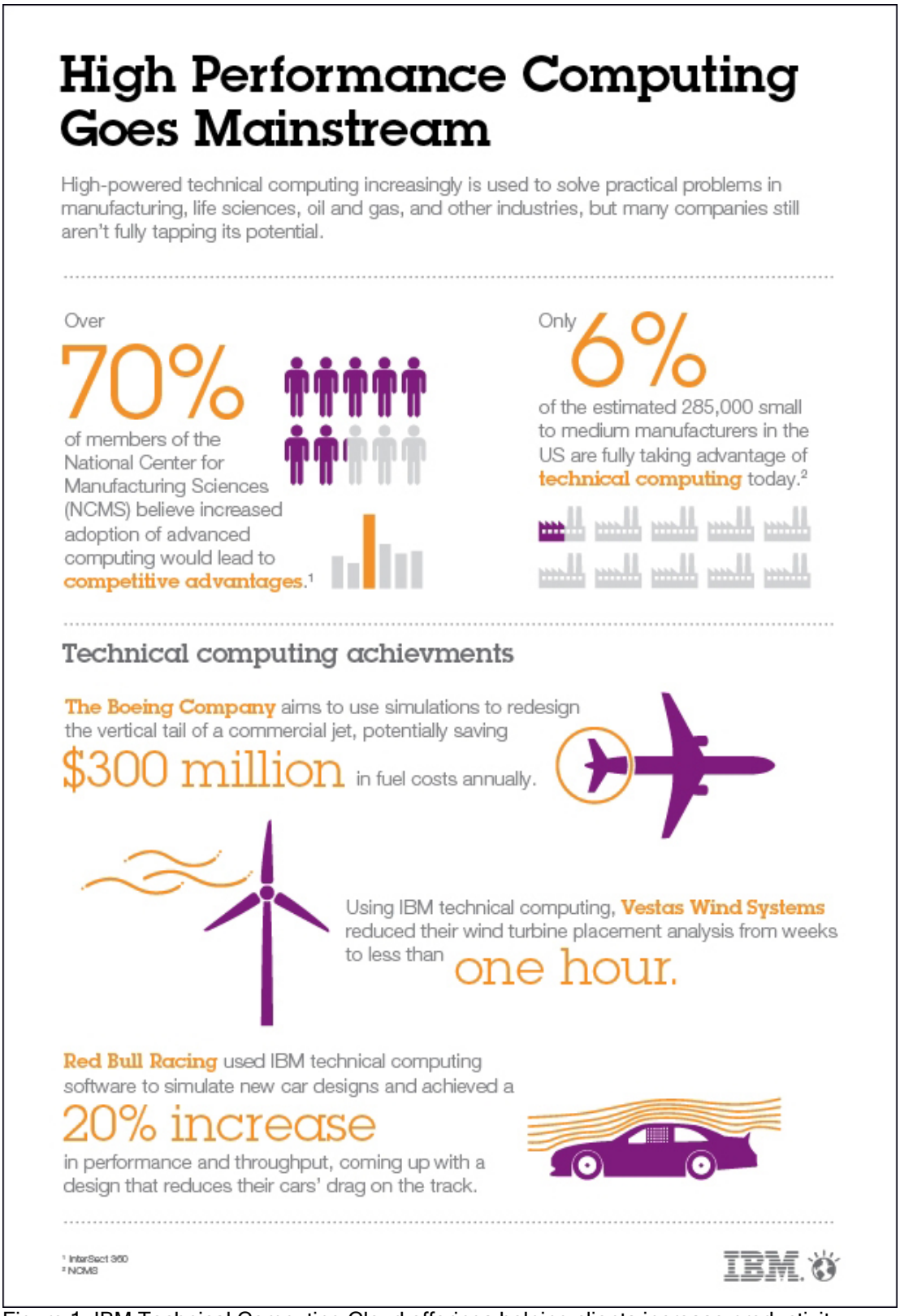

Figure 1. IBM Technical Computing Cloud offerings helping clients increase productivity

Did you know?

These solutions can be applied in a wide range of industries. For example, automotive, aerospace, and electronics companies that are focused on electronic design automation (EDA), computer-aided engineering (CAE), and big data analytics all benefit greatly from a highly optimized cloud environment. IBM Engineering Solutions for Cloud are further strengthened by adding two-dimensional and three-dimensional accelerators and dynamic provisioning to create a secure, agile, and cloud-based engineering environment that can visualize and manipulate two-dimensional and three-dimensional models, increase user productivity, and improve application performance. These solutions enable you to further consolidate HPC resources by co-locating remote visualization GPU-enabled servers in the HPC environment.

IBM Engineering Solutions for Cloud can be augmented with IBM System Storage® products and the IBM General Parallel File System (IBM GPFS™) to deliver high performance enterprise file management, which allows you to truly optimize data management.

Business value

Platform Computing Services have industry-proven experience to help organizations plan, deploy, and manage optimized clusters, grids, big data analytics, and HPC clouds. These offerings provide a broad range of services, from consulting and custom engineering to administration services and ongoing education.

Based on cluster, grid, analytics, and HPC cloud technology, IBM cloud offerings are built on scalable, high performance platforms. They have intuitive and versatile user interfaces, robust “resource-aware” job scheduling, and workload aware and user-driven provisioning and powerful management capabilities to help ensure that departmental, enterprise, or community resources are optimally deployed, simple to use, and easy to manage. With IBM cloud offerings, you can be confident that you are getting the optimal performance and processing efficiency out of your hardware and software resources. Your organization gains greater access to computing and application resources, and benefits from higher throughput for faster time to results and improved administrator and user productivity. You can align resources with project priorities and realize improved operational and cost efficiencies while achieving business goals that might be unattainable with other cloud solutions.

These big data analytics and HPC cloud offerings provide a foundation for the IBM Engineering Solutions for Cloud with which you can build a centralized, secure, and shared product development environment. By using workload and resource-optimized web portals, management tools, and accelerators, IBM Engineering Solutions for Cloud enable you to access a design environment and collaborate from almost any device, anywhere in the world.

The high performance computing cloud offerings from IBM have the following attributes:

- They are developed specifically for compute-intensive and big data analytics distributed computing environments.
- They are powered by industry-leading hardware and IBM Platform Computing cluster, grid, and HPC cloud management software.
- They offer a robust and integrated solution with a single point of administration.
- They speed the provisioning of big data analytics and high performance computing clouds.

Solution overview

If a cloud computing solution enables users to share resources across multiple clusters, create and access their own clusters on demand, or submit jobs through a portal, your organization could move beyond inefficient, project-oriented, and static environments to a dynamic shared infrastructure. If the cloud solution also is smart enough to allocate the correct resource at the correct time (on bare metal systems, clusters, or virtual machines), the solution can drive a transformation to a dynamic and flexible environment that can satisfy many needs.

Whether you have been working with HPC and analytics for years or you must deploy your first system, offerings from IBM can help you manage your HPC and analytics environments using cloud computing technology. Specifically designed for private and private hosted HPC clouds, these offerings include the following ones:

- HPC cloud management software from IBM Platform Computing: Powerful cloud infrastructure and workload management tools to help improve productivity, agility, and reduce costs.
- IBM Intelligent Cluster™: An integrated, optimized high performance platform with a single point of contact.
- HPC cloud services: Professional services to help clients assess, build, optimize, and manage an HPC cloud. As an bonus, Platform Computing is able to provide system administrator and user training to help ensure ongoing success.

Conversely, cloud computing enables convenient, on-demand access to a shared pool of configurable computing resources, such as servers, networking, applications, and services. These shared resources can be rapidly deployed and redeployed with minimal human intervention to meet resource requirements. You can rapidly change the resource to match the immediate need of the workload in minutes instead of hours or days. For example, multiple computer-aided engineering loads can process faster in an environment that is able to scale to meet demand, which makes cloud computing efficient, flexible, and collaborative.

For the technical user community, the implications are enormous. By applying cloud principles to established HPC and analytics infrastructures, silos vanish and shared computing resources can be used on a project-by-project basis, which maximizes the operational efficiency of existing clusters. The transition to cloud computing can help you accomplish the following goals:

- Enhance productivity and enable collaboration with an easy-to-use, web-based portal.
- Improve data access, resource availability, and security while boosting administrator and user productivity.
- Increase throughput of heterogeneous workloads, reducing time to results.
- Reduce costs by maximizing the usage of consolidated an HPC and analytics infrastructure.

Solution architecture

Cloud computing is a natural evolution for HPC and big data analytics, particularly for engineering and scientific applications that already use cluster and grid computing today. The cloud offerings from IBM are designed to transform isolated and static technical computing resources into high performance clouds that can be shared, remotely managed, and easily provisioned to support the demands of compute-intensive and big data workloads and changing user requirements. Your organization can deploy an efficient, consolidated infrastructure that meets time-variant and evolving business demands while also delivering the performance that your users demand.

The HPC cloud management software suite from Platform Computing (Figure 2) provides a comprehensive set of powerful workload, resource, and cloud management capabilities. Featuring intuitive user and system administrator portals, robust application programming interfaces (APIs), command-line interface support, and integration with leading independent software vendors (ISV) offerings and tools, the Platform Computing software is powerful yet easy to use. It supports intelligent resource sharing across multiple clusters and grids, and automated workload and process management for service-oriented and batch workloads. Because it provides automated provisioning capabilities that are based on workload, you can ensure that your users have access to the best resources that are available to meet their application performance requirements and committed service level agreements (SLAs).

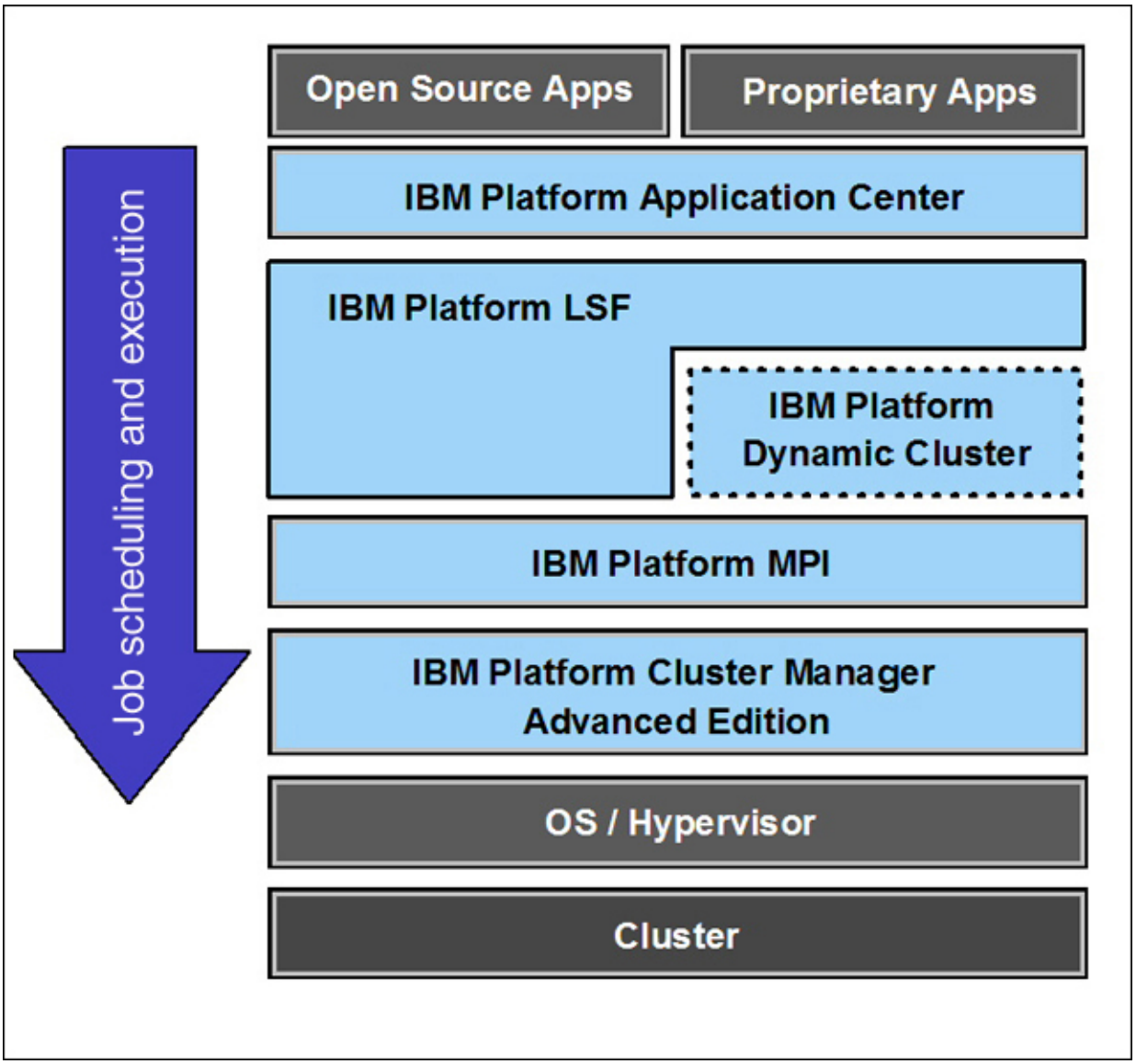

Figure 2. IBM Platform Computing

Usage scenarios

Platform Computing provides a comprehensive set of cloud management capabilities that are designed to work together to address your analytics and HPC cloud needs.

- IBM Platform LSF® is a powerful workload management platform for demanding, distributed HPC environments. It provides a comprehensive set of intelligent, policy-driven scheduling features that help you use all of your computing infrastructure resources and ensure optimal application performance.
  - Platform Application Center provides a flexible, application-centric, and easy-to-use interface for cluster users and administrators. Available as an add-on module to Platform LSF, Platform Application Center enables users to interact with intuitive, self-documenting standardized interfaces to ISV applications, tools, and hardware platforms.
  - Platform Process Manager enables Platform LSF users to design computational processes that can capture and protect repeatable preferred practices. Workflow steps and dependencies are documented through an intuitive GUI, enabling users to automate lengthy, repetitive tasks that are prone to human error.
  - Platform Dynamic Cluster turns static Platform LSF clusters into a dynamic cloud infrastructure. By automatically changing the composition of clusters to meet ever-changing workload demands, service levels are improved and organizations can do more work with less infrastructure.
- IBM Platform HPC is a complete high performance computing management solution in a single product. It includes a range of features that are designed to help reduce the complexity of your HPC environment and improve your time-to-solution, including as easy-to-use interface and dynamic operating system multi-boot capabilities.
- IBM Platform Symphony® software delivers powerful enterprise class management for running compute and data-intensive distributed applications on a scalable, shared service-oriented grid. It accelerates dozens of parallel applications for faster results and better usage of all available resources.
- IBM Platform Cluster Manager - Advanced Edition delivers the infrastructure management that is needed to consolidate disparate HPC and analytics clusters into a shared pool of resources, and provides one centralized interface to simplify management. It enables the self-service creation and management of multiple flexible clusters from that pool of resources to deliver the performance that is required by the compute-intensive workloads in multitenant HPC and big data analytics environments.
- IBM General Parallel File System (GPFS) is important software to help you manage a cloud. The GPFS high performance shared disk file management solution can manage petabytes of data and billions of files for fast and reliable access to a common set of file-based data that can be accessed globally and managed centrally.

Integration

In support of analytics and HPC cloud environments, the Intelligent Cluster is an ideal systems foundation for shared simulation, computer modeling, and analytics domains, such as electronic design automation (EDA), computer-aided engineering (CAE), oil and gas, life sciences, or Monte Carlo simulations. These clusters are customizable with a choice of leading IBM System x® servers (including rack servers, blades, and IBM iDataPlex®), the latest high-speed switches, storage, graphics processing units (GPUs), operating systems, and Platform Computing software. They can be preintegrated with one order number and support structure. iDataPlex, with dx360 M4 nodes and NVIDIA graphics adapters, works well for remote three-dimensional visualization applications or where performance, density, and energy-efficiency matters. If a high-performance integrated blade platform is needed, IBM Flex System® can serve your needs.

IBM Scale Out Network Attached Storage is designed to embrace the scale and demands of cloud storage in the petabyte age. Scale Out Network Attached Storage serves as storage gateway with the ability to handle not only large files, but also smaller random access file workloads, all under a single file system, which is a key differentiator in the industry. When paired with GPFS and IBM System Storage DCS3700, which is a dense, modular high performance storage system, block and file based storage needs are addressed with the performance and scale users demand.

Supported platforms

For information about the supported operating systems, platforms, or other key prerequisites, go to http://www-03.ibm.com/systems/technicalcomputing/platformcomputing/index.html.

Ordering information

It might seem like a massive job to move from a traditional HPC environment to one that uses cloud technology, but IBM offers a wide range of professional and support services to simplify your step-by-step transition. Whether you are migrating existing systems and applications or deploying new ones, HPC cloud consulting, implementation, and hosting services from IBM can help you develop and execute a holistic cloud strategy that is tailored to your needs. IBM can also help your team develop HPC cloud expertise through hands-on system administrator and user training.

To learn more about enhancing your HPC or technical computing environment with cloud technology, contact your IBM representative or visit ibm.com/technicalcomputing or ibm.com/platformcomputing.

Ordering information is shown in Table 1.

Table 1. Ordering part numbers and feature codes

Program number	VRM	Feature description	OTC billing feature number	SEO number
5641-HP6	4.1.1	Platform HPC for System x V4.x, Per Managed Server with 1-Year SW S&S	0724	00FE948
5641-HP7	4.1.1	IBM Platform HPC for System x V4.x, Per Managed Server with 3-Year SW S&S	0725	00FE949
5641-HP8	4.1.1	Platform HPC for System x V4.x, Per Managed Server with 5-Year SW S&S	0726	00FE950
5641-PL1	9.1.1	Platform LSF Standard for Platform HPC, V9.x, Per RVU with 1-Year SW S&S	0719	00FE954
5641-PL1	9.1.1	Platform LSF Standard for Platform HPC, V9.x, Per 250 RVU with 1-Year SW S&S	0718	00FE955
5641-PL3	9.1.1	Platform LSF Standard for Platform HPC, V9.x, Per RVU with 3-Year SW S&S	0720	00FE956
5641-PL3	9.1.1	IBM Platform LSF Standard for Platform HPC, V9.x, Per 250 RVU with 3-Year SW S&S	0721	00FE957
5641-PL5	9.1.1	IBM Platform LSF Standard for Platform HPC, V9.x, Per RVU with 5-Year SW S&S	0722	00FE958
5641-PL5	9.1.1	IBM Platform LSF Standard for Platform HPC, V9.x, Per 250 RVU with 5-Year SW S&S	0723	00FE959

Related information

For more information, see the following documents:

- *IBM Platform Computing Solutions Reference Architectures and Best Practices*, SG24-8169
  http://www.redbooks.ibm.com/abstracts/sg248169.html
- *IBM Technical Computing Clouds*, SG24-8144
  http://www.redbooks.ibm.com/abstracts/sg248144.html
- *Introduction to IBM Technical Computing Clouds*, TIPS1023
  http://www.redbooks.ibm.com/abstracts/tips1023.html
- IBM Technical Computing
  http://www-03.ibm.com/systems/technicalcomputing/platformcomputing/
- IBM Offering Information page (announcement letters and sales manuals):
  http://www.ibm.com/common/ssi/index.wss?request_locale=en

  On this page, enter IBM Technical Computing, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service. IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you. This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you. Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

This document was created or updated on April 28, 2014.

Send us your comments in one of the following ways:

- Use the online **Contact us** review form found at:
  ibm.com/redbooks
- Send your comments in an e-mail to:
  redbook@us.ibm.com
- Mail your comments to:
  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400 U.S.A.

This document is available online at http://www.ibm.com/redbooks/abstracts/tips1177.html .

Trademarks