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WHITE PAPER

Linux Application Development Ready for Prime Time

Sponsored by: IBM

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EXECUTIVE SUMMARY

As a result of the developments described in this white paper, IBM has emerged as an unparalleled provider of application development and deployment tools while simultaneously extending these development and deployment capabilities to Linux.

Linux initially developed a reputation as a high-performance deployment environment, but IDC is now seeing an increasing amount of application development occur on Linux. The reason for this growth is threefold. First, the availability of integrated development environments (IDEs) that run on Linux has reached critical mass. Second, development on Linux is considerably easier and safer than development on other operating environments when the deployment environment is Linux. Third, Linux provides a secure, reliable, and flexible platform for software development.

IBM has put to rest the common perception that there are no extensively featured IDEs for Linux by providing a sufficiently comprehensive, well-integrated development platform for Linux. It uses Eclipse as its tool integration framework and IBM Rational tools, integrated on top of or in Eclipse, to supply the functions required by various players across the development life cycle. Rational software offers a comprehensive solution that allows developers to leverage Linux to build, integrate, expand, modernize, and deploy software. With broad support for all roles and activities in the software life cycle, Rational products support development on Linux as well as development for Linux. These tools are available individually or as part of the integrated platform: the IBM Rational Software Development Platform.

IBM has complemented this platform with an array of other services and tools to facilitate the migration of existing software from x86 platforms to IBM's POWER and zSeries systems. It is also providing Cloudscape and PHP support to further developer use of other open source software.

IBM's continuing commitment to open standards, Java, open source, and its business partners provides a level of community and collaboration that is unique in the software industry today.

IBM LINUX SUPPORT QUALIFIES AS FIRST RATE

Many independent software vendor and enterprise executives today have realized that software development is a business process that has as definite and significant an impact as other critical business processes in their organizations. Thus, larger organizations require disciplined management oversight of their software development activities to ensure that they are closely aligned with short-term and long-term business objectives and executed efficiently to deliver real value to enterprises.

One important decision affecting IT cost structure is the choice of operating environments. Organizations, in increasing numbers, are adopting Linux to minimize both operating environment license costs and ongoing operational management costs associated with the reliability, security, and robustness of an operating environment. IBM has recognized and embraced this trend. Today, organizations can run Linux on a variety of hardware systems from IBM and other vendors.

Linux Adoption

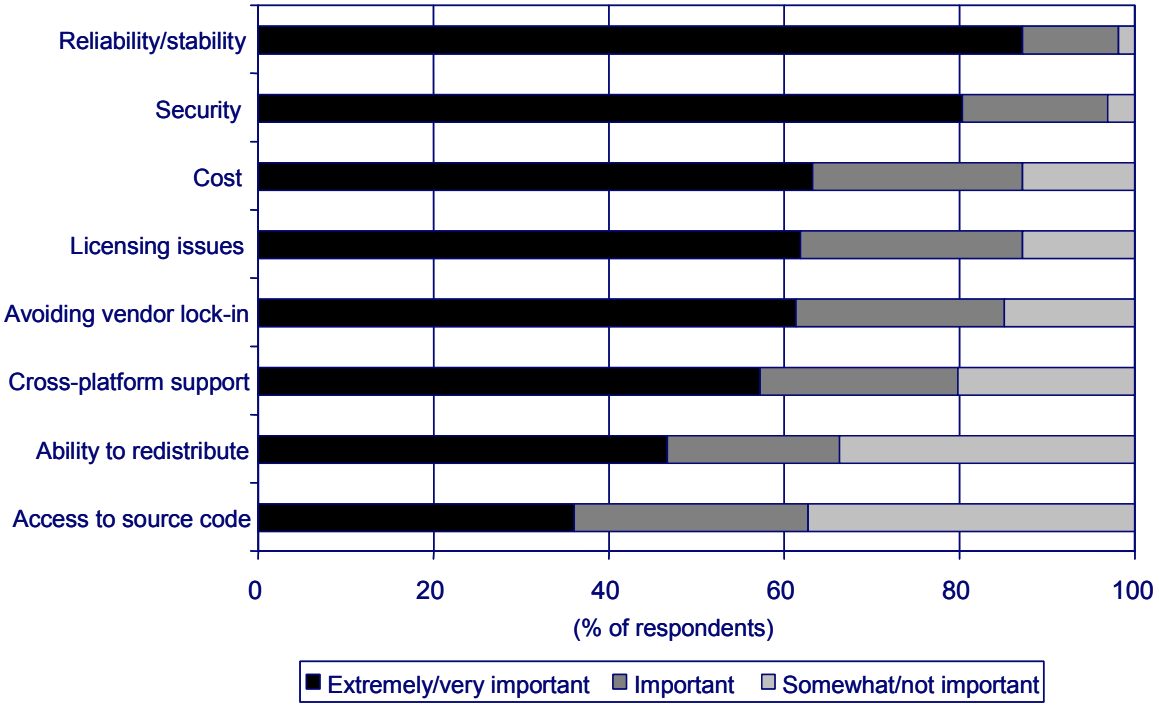
The Appeal of Linux and Other Open Source Software

Linux is one of the best examples of a successful open source software product. In the summer of 2004, IDC surveyed organizations that had experience with open source software. It was clear that open source software was highly regarded by the 617 technology and business professionals who answered the survey. Figure 1 shows responses from IDC's 2004 Open Source Survey for 349 respondents who provided data when asked what factors make open source software attractive to them. The data presented in Figure 1 draws from and reflects respondents' organizational experience with open source software products.

FIGURE 1

What Organizations Find Attractive About Open Source Software

Q. What makes open source software attractive to your organization?



n = 349

Note: Data is weighted.

Source: IDC, 2005

The data in Figure 1 has been consolidated from the original five categories into three categories. Reliability/stability and security are the two leading factors that organizations find attractive about open source software, with 87% of respondents reporting that reliability/stability is either extremely important or very important and 80% of respondents indicating that security is either extremely important or very important. Cost and licensing flexibility are also considerations, but these factors are clearly secondary in importance to reliability and security. These findings suggest that organizations have had highly positive experiences with open source products to date, undoubtedly building on the strength of Linux and Apache.

The Linux Operating System

Linux began as an operating system solution for systems built on the x86 processor, but in the past several years it has expanded its range to cover nearly every mainstream hardware platform in use. Of particular interest to developers is the fact that Linux operating systems have been ported beyond traditional client and server systems; Linux is widely used in the embedded processor market as an operating system and is even seeing adoption aboard next-generation mobile phones.

Linux first emerged as a server operating environment (SOE), while client-side adoption has grown at a slower pace, especially for general-purpose deployment. This profile is related to the similarity between Linux and Unix, both of which are well regarded as server environments. IDC studies find that most organizations, even Windows-centric organizations, have installed some Linux. Organizations not currently using Linux in production typically have some piloting or evaluating activities under way.

In 2003, paid Linux SOE shipments accounted for 18.5% of the worldwide total of new paid SOEs. Only Windows, which captured 61.6% of SOE new license shipments, surpassed Linux. By comparison, Unix SOE shipments accounted for 11.2% of the worldwide total in 2003, the most recent data currently available. IDC's forecast calls for Linux SOE shipments to increase at a 2003–2008 compound annual growth rate of 19.7%, which is 9% higher than the growth rate forecast for Windows SOE shipments.

Client-side data shows Linux shipments of client operating environments (COEs) running in the low single digits, with early adopters likely to be using those platforms for Web application development and other technical uses.

Developer Use of Linux

IDC's Software Developer Collaborative, which reports worldwide data on key application development and deployment issues, is currently evaluating developer activities. A full 50% of the 1,215 respondents in the North American interim survey reported that their use of Linux is increasing compared with just 1% who indicated that Linux use is decreasing and 16% who reported that Linux use is unchanged. The important finding is that 66% of North American respondents are actively using Linux. Although we expect this number to change as additional developer communities weigh in, Linux already clearly ranks as an important development environment.

IBM and Linux

Linux has been embraced by most major OEMs, particularly as a solution for x86-based servers, but IBM was one of the first vendors to see its potential. Linux brings a common operating system to IBM's four hardware platforms and offers a software environment that both supports cutting-edge applications being developed today and is familiar to new IT professionals who are graduating from college and joining the pool of available talent. Linux distributions are available from both Red Hat and Novell/SUSE for the zSeries, pSeries, iSeries, and xSeries platforms.

To support its broad Linux server portfolio, IBM has expanded the coverage of its key infrastructure and middleware software products to include Linux as a tier 1 platform. Accordingly, new releases emerge for all of IBM's Linux platforms in parallel to the release of x86-targeted software products.

Not surprisingly, the largest overall volume of Linux deployments today remains aboard servers built on x86 processors. However, Linux now runs on many different processor architectures which increases the flexibility and potential benefits available to businesses implementing Linux. Fortunately, applications developed for x86 servers are easily ported to other hardware architectures. To boost the adoption of Linux aboard IBM's POWER-based (pSeries, iSeries, and OpenPower) and zSeries hardware, IBM unveiled its no-charge "Chiphopper" offering, which provides the tools, education, and joint marketing to help ISVs port their existing Linux x86 applications over to IBM POWER-based and zSeries hardware and middleware, backed by post-port assurance.

In addition, IBM has a parallel program to encourage ISVs to port their applications from Solaris to Linux, the IBM Solaris-to-Linux Migration Factory.

Development on Linux

One aspect of Linux and other operating environments offered by IBM is the support that comes with the IBM application development environments. IBM supports both development for and development on Linux. Because IBM treats Linux like its other tier 1 operating environments, much of the following discussion about IBM's comprehensive application development environment is not limited to Linux. A key planning assumption for IBM is that developers will be working in a heterogeneous environment and deploying applications for multiple operating environments, including Windows.

One common perception is that there are no extensively featured IDEs for Linux. Although this may have been true historically, it is no longer true. IBM has a comprehensive, well-integrated development platform for Linux, and this white paper explains the breadth of this offering. IBM uses Eclipse as its tool integration framework and IBM Rational tools, integrated on top of or in Eclipse, to supply the functions required by various players across the development life cycle.

For some time, IBM has been assembling and integrating a comprehensive development environment by merging extensions of internally developed tools with those gained from recent acquisitions, the most important of which was its acquisition of Rational. For most of its existence, Rational has been almost totally Windows-centric and not very involved with Linux. That situation changed dramatically when IBM acquired Rational and redirected development toward Eclipse and cross-platform support, including Linux. The result, announced last fall, represents a major evolution of the Rational tool suite and IBM's development environment: the IBM Rational Software Development Platform.

KEY CAPABILITIES OF A FULL LIFE-CYCLE SOFTWARE DEVELOPMENT SOLUTION

A full life-cycle software development environment should have most of the following key characteristics:

- **Openness and flexibility.** Developers should have the flexibility to choose domain-specific languages, add third-party utilities and tools, target multiple deployment platforms and information sources, and customize each of their user interfaces within a common development framework that is open and supports the integration of a variety of tools sharing a common metadata repository.

- **Inclusiveness and tolerance of heterogeneity.** Most organizations today have and use a wide variety of tools from multiple vendors. The adoption of a software development environment cannot preclude the continued use of tools already in use. The same is true of information sources. Support for data access and transformation must be available for the integration of a variety of relational database management systems (RDBMSs) and legacy data needed for today's complex business transactions. Finally, the software development environment must address cross-platform development.

- **Role-based tools.** Many different roles are part of the overall development life cycle. They range from the people who gather user requirements to the people who conduct the analysis, design, coding, testing, quality assurance and deployment, and even post-deployment tasks such as maintenance and optimization. The best life-cycle tools support the methodologies and paradigms used by practitioners in each of these roles.

- **Integration of metadata and sharing of development artifacts.** Historically, the tools used in different roles have been isolated or have supported only minimal information sharing across the life cycle. More modern development tools have common repositories with shared metadata and the ability to find and reuse many types of software development artifacts, including requirements, models, patterns, code, and tests. Such sharing includes the ability to use artifacts created by one role (e.g., models) to create additional artifacts (e.g., source code).

- **Collaboration.** The oft-cited line "Software development is a team sport" is true. A good software development environment needs to provide for collaboration among developers with the same roles and between roles. It must also support distributed, multisite development.

- **Project management.** The software development environment needs to be aware of and support the collection of information to support project monitoring and reporting.

- **Maturity and robustness.** All development environments evolve in order to remain competitive. Nevertheless, it is more effective to employ tools that are widely used, stable, and relatively bug free.

Software development environments with these characteristics will have the scope and power to truly enable a software development organization at maximum efficiency.

IBM RATIONAL SOFTWARE DEVELOPMENT PLATFORM

The IBM Rational Software Development Platform is a comprehensive solution which provides a unified development environment which spans the full breadth of the application life cycle. With it, an organization obtains the technology foundation and software process enablement to truly treat software development as a first-class business process, setting the stage for its developers to more effectively align IT resources with business goals.

Overall Architecture of the IBM Rational Software Development Platform

The architecture of the IBM Rational Software Development Platform is centered around the Eclipse framework for tool integration and powered by various Rational development tools, and it is consistent with the IBM Rational Unified Process (RUP) for application development. One of the most important aspects of RUP is that it is extensible and can be customized to any organization.

Eclipse

Eclipse was originally developed by IBM but was released as open source. Now its evolution is managed by an independent organization, the Eclipse Foundation. Eclipse is best known for its Java developer support, but the Eclipse framework can and does support other languages and, more important, provides the framework for the integration of a variety of developer tools. The result has been the creation of an independent open ecosystem around royalty-free technology and a universal platform for tools integration.

> "Eclipse-based tools give developers freedom of choice in a multilanguage, multiplatform, multivendor environment. Eclipse provides a plug-in–based framework that makes it easier to create, integrate, and utilize software tools, saving time and money. By collaborating and exploiting core integration technology, tool producers can leverage platform reuse and concentrate on core competencies to create new development technology. The Eclipse Platform is written in the Java language and comes with extensive plug-in construction toolkits and examples. It has already been deployed on a range of development workstations including Linux, HP-UX, AIX, Solaris, QNX, Mac OS X, and Windows–based systems." [From the Eclipse.org Web site]

The importance of Eclipse to the IBM Rational Software Development Platform cannot be overstated. The platform and the Rational tools are integrated on or in the Eclipse framework and leverage the Eclipse core, the Eclipse Modeling Framework (EMF), the Graphical Editor Framework (GEF), and Hyades. Hyades is an integrated test, trace, and monitoring environment, based on Eclipse, that provides standards, tools, and tool interoperability across the test process. For example, the EMF allows the various tools to present the same or related information differently in each tool according to the presentation paradigm of the user's role. UML information seen by the architect is viewed as code by the programmer. Using tool-specific APIs, each tool extracts what is needed by an individual developer. This same principle allows other non-IBM tools to be "plugged in" to the platform. This is especially useful for mixed development shops working with IBM and other development environments.

The benefit to IBM of using Eclipse is that it is open and modular. IBM can tightly integrate its tools with the Eclipse framework. Eclipse is truly open. It allows IBM to host tools on a variety of platform, including Linux. As a player, albeit a prime player, in the Eclipse ecosystem, IBM can expect the other players to contribute to the ongoing evolution of the framework. A plethora of projects are currently under way within the Eclipse Foundation with this goal. Examples are the Eclipse 3.0 Rich Client Platform and the new Eclipse plug-in to support Apache Geronimo.

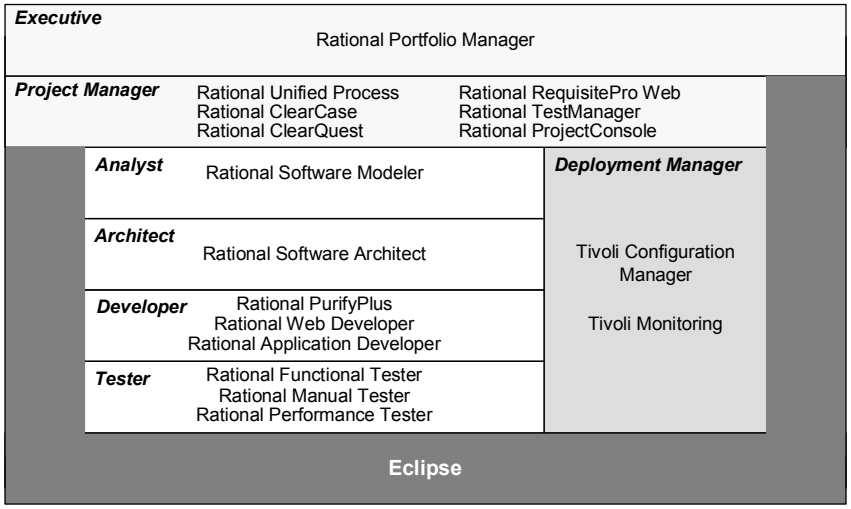
The IBM Rational Tools

IBM has combined all its development tools under the Rational brand, as shown in Figure 2. Some of these tools came with the Rational acquisition; others were previously marketed under the WebSphere brand. Regardless, most of these tools are mature, robust tools that have been migrated to the Eclipse framework. Full life-cycle coverage is provided:

- Business requirements and analysis
- Design, construction, and unit test
- Quality assurance
- Software configuration and change management
- Team collaboration and process management
- Project portfolio management

FIGURE 2

The IBM Rational Software Development Platform



Source: IDC and IBM, 2005

This set of tools provides the following benefits:

- Improved productivity provided by support for multiple development paradigms (e.g., rapid application development [RAD], model-driven development, and agile development)
- Tighter project control and lower project risk through the use of RUP, requirements specifications, and detailed modeling, including use cases
- Higher-quality, more robust software at time of release, measured in terms of reliability, performance, scalability, and ability to meet user requirements
- Lower development costs and quicker development times through support for distributed, multisite development in conjunction with lower-wage countries in Asia or Eastern Europe
- Better allocation of development resources within and across the various projects in the IT portfolio
- Incremental investment (Because the IBM Rational tools are modular and plug in to the same Eclipse framework, organizations have the option of incremental adoption and gradual investment.)

Business Requirements and Analysis

One definition of quality is performance to requirements. In other words, the quality of software under development is good if it meets the stated requirements for which it was developed. Developing software without requirements is like trying to travel without a clear destination. You don't know where you will end up.

IBM Rational provides analysts and architects with a tool to capture, refine, and model a project's business requirements and the derived models of user interaction and database architecture. These models can then be maintained as the project evolves in response to additions and changes and as related choices are made by the project architects in response to the requirements.

Analysts can also use their Web browsers to access the user requirements that have been documented with IBM Rational RequisitePro, a Windows-based requirements management tool.

IBM Rational Software Modeler

This visual modeling and design tool supports UML2 modeling to capture and communicate various aspects of a software design. It is not for code generation or round-trip model/code synchronization. It includes support for transform authoring and a browser for finding reusable assets. Some aspects of the modeling are actually assisted or automated.

Design, Construction, and Unit Test

Several tools are supplied for software design and construction as part of the IBM Rational Software Development Platform: These tools are meant to be used by architects and developers and have been packaged so that they can be purchased separately or in integrated bundles, as shown in Figure 2. IBM has taken this approach because architects and developers may use many different development paradigms, from model-driven to more code-centric, and will want to choose the appropriate tool for their needs.

IBM Rational Software Architect

This tool includes full modeling capabilities and is integrated with the application development capabilities discussed below for design and construction. It can perform UML transforms and code generation. Some of the extra features include the ability to perform architecture discovery and, as an adjunct, to find and control antipatterns. Antipatterns are known examples of less desirable architectures. Architects are always looking for unintended consequences. These capabilities allow architects to ensure the structural integrity of their designs and minimize any related rework later on that might be complicated by complex, poorly designed interdependencies.

As mentioned previously, analysts can also use their Web browsers to access the user requirements that have been documented with IBM Rational RequisitePro.

IBM Rational Application Developer

This tool is an integrated development environment for the design and development of Web, Web services, Java, J2EE, and portal applications. Some entry-level UML editing capabilities are included. The rich IDE includes support for Java Server Faces (JSF) and Service Data Objects for more efficient J2EE development. The commonly used Model-View-Controller (MVC) pattern is also supported with JSF. IBM Rational Application Developer also provides comprehensive code review for static and runtime analysis (see IBM Rational PurifyPlus section). Developers can check code compliance with J2EE/J2SE best practices, organizational coding styles, naming conventions, and other design principles. Violations are highlighted in the code editor and listed by severity, with examples of what corrective action to take. By doing this earlier in the development cycle when problems are easier to find, the effort of developers to isolate and fix coding errors is minimized.

Capabilities for component testing are included to support the verification of component functionality. Developers can find and fix functional deficiencies earlier in the software development life cycle, thus minimizing system-level testing and integration problems later. Unit and API testing can be automated, guided, and supported by statistics-based guidance for test prioritization and automatic generation of stubs.

The capabilities and scope of coverage for Application Developer are excellent. It includes tools for code visualization, integration with legacy systems, rapid application development, and model execution. IBM Rational Application Developer functionality is also subsumed by IBM Rational Software Architect, which fully supports model-driven development.

IBM Rational Web Developer

This high-productivity RAD tool is focused on Web development. It contains the functionality needed by developers to build, test, and deploy Web, Web services, and Java applications as well as rich Internet clients. IBM Rational Web Developer supports HTML, JavaScript, servlets, and JSO. Its functionality is embedded in the IBM Rational Application Developer.

IBM Rational PurifyPlus

This tool provides runtime analysis and includes four basic functions: memory corruption detection, memory leak detection, application performance profiling, and code coverage analysis. PurifyPlus packages support for all of these functions in a single product.

Alternatives for Developing Technical and Embedded Applications

If the types of applications being developed are more real-time or embedded in nature, then some other Rational tools come into play. The additional relevant tools are IBM Rational Device Developer, IBM Rational Micro Environment Toolkit, IBM Rational Embedded Voice Toolkit, WindRiver Tornado, Green Hills MULTI, Microsoft eMbedded, IBM Rational Technical Developer, and IBM Rational Test RealTime. A discussion of real-time tools is beyond the scope of this white paper, but the point is that IBM support for development on and for Linux goes well beyond the domain of business applications (e.g., software that is intended to run on handheld devices or cell phones or that is embedded in toys).

Quality Assurance

IBM provides a comprehensive suite of quality assurance (QA) tools for functional and performance testing. Collectively, the IBM Rational QA tools help ensure that new applications meet requirements, including functional, performance, scalability, and usability needs. The IBM Rational QA tools help QA teams maximize test coverage and optimize testing through automation.

IBM Rational QA tools include:

- **IBM Rational Manual Tester,** a manual test authoring and execution tool that helps testers and business analysts capture, organize, and manage their tests and maximize test step reuse so that tests are more resilient to change over time
- **IBM Rational Functional Tester,** a test automation tool for functional and regression testing that supports Web-based, Java, and Visual Studio.NET applications
- **IBM Rational Performance Tester,** a test automation tool for performance, load, and stress testing that allows performance test teams to verify the reliability and scalability of new applications before they are deployed in production

IBM also provides IBM Rational Robot, the original Rational functional and performance test tool, which provides script-based test automation for centralized QA groups.

The IBM Rational QA tools integrate with the IBM Rational Team Unifying Platform for overall team collaboration including test management and defect tracking.

Software Configuration and Change Management

The IBM Rational Software Development Platform includes the market-leading IBM Rational ClearCase and IBM Rational ClearQuest software configuration and change management products. These enterprise-class products provide management and control over all of the software development artifacts for development teams of any size, in any number of geographical locations, for projects of any level of complexity.

Today's software development teams are characterized by diversity: They may include team members in remote locations, external resources such as outsourcers and consultants, or partners. Today's geographically distributed development teams need high-performance software configuration management systems that provide strong process management and change control.

The software configuration and change management system also plays a critical role in ensuring compliance with the increasing number of government regulations with which the typical enterprise must comply. Robust change and process management capabilities provide the traceability for successful audits.

IBM's software configuration and change management products include:

- **IBM Rational ClearCase,** a family of software configuration and change management products that supports teams of any size, from those undertaking smaller projects working at just one location to those undertaking large projects with geographically distributed teams (IBM Rational ClearCase MultiSite option provides support for replicated repositories.)

- **IBM Rational ClearQuest,** which provides integrated workflow management and defect and change tracking across the software development life cycle

IBM also provides SCLM Plus for z/OS, a mainframe software configuration management system. SCLM Plus' integration with ClearQuest supports development teams that need to manage source code on both distributed and mainframe systems.

Team Collaboration and Process Management

A particular strength of the IBM Rational Software Development Platform is the underlying solid software development methodology. The IBM Rational Unified Process (RUP), a configurable, best practices–based methodology, is one of the most popular methodologies in use today. IBM Rational SUMMIT Ascendant provides process templates and Web-based tools for planning and estimating that complement RUP.

IBM Rational Team Unifying Platform supports IBM Rational's full life-cycle vision by providing the collaboration tools and common repository that facilitate effective teamwork through consistent processes. IBM Rational Team Unifying Platform gives team members shared access to all software development artifacts and provides support for collaboration through role-based workflows and notifications. Team members and managers have full visibility into project status and health via the Web-based IBM Rational Project Console.

Project Portfolio Management

IDC research continues to highlight project management weaknesses as one of the prime causes of the failure of new applications. Improving project management can enhance the return on investment (ROI) of new applications. This is particularly important given today's climate of constrained IT budgets and the pressure on IT to "deliver greater business value."

Consequently, enterprises are increasingly turning to project portfolio management systems to help them prioritize and plan their IT investments. Project portfolio management systems facilitate joint business/IT planning, helping to ensure better alignment between IT resources and business needs and improving visibility into how resources and costs are allocated across all projects in the IT portfolio. Portfolio management systems provide support in areas such as project estimation and costing, resource allocation and scheduling, and scenario planning and impact analysis. A portfolio view also provides a risk-based assessment of how IT resources are invested and facilitates better trade-off analysis during the life cycle of the investment.

IBM Rational Portfolio Manager is a full-featured project portfolio management system that provides a top-down view of how IT resources are allocated across all projects. Integration of IBM Rational Portfolio Manager with the IBM Rational Team Unifying Platform ensures that IT management always has an up-to-date and accurate view of the status of all projects — information that is essential for accurately planning and resourcing new investments and responding to changing business needs.

The Link from Application Development to Operations

The more structured approach that we are seeing in application development — beginning with requirements management and including analysis, modeling, design, development, and test — now links with an equally comprehensive series of activities encompassing software distribution, monitoring, and management.

Configuration Management and Monitoring

Deployment includes those activities that facilitate the transfer of an application from the development and-test environment into production. Deployment activities typically encompass automated software distribution and automated monitoring to detect potential problems and recover from critical situations. IBM has bridged the classic gap between application development and operations with IBM Tivoli Configuration Manager and the IBM Tivoli Monitoring product family.

IBM Tivoli Configuration Manager

IBM has brought together IBM Rational ClearCase and IBM Tivoli Configuration Manager to provide a more extensive and seamless enterprise solution to help automate and manage software builds and deployments. Key features of these combined products address many aspects of software update management, including secure enterprisewide software distribution control, rollback, trace, dependency checking, audit, and access. IBM Tivoli Configuration Manager can also securely perform these functions across systems operating outside corporate firewalls.

IBM Tivoli Monitoring

IBM's Tivoli brand addresses application management, application availability, business service management, orchestration and provisioning management, security, storage management, and optimization. Although most of the Tivoli products address system, network, and operational needs, a number of the IBM Tivoli monitoring products are aimed at bridging the gap between development and operations. IBM Tivoli Monitoring is designed to monitor essential system processes seeking to detect resource bottlenecks and identify resource utilization trends that will adversely affect system performance and automatically recover from critical situations.

IBM Tivoli Configuration Manager and IBM Tivoli Monitoring support virtually all of the leading Unix operating environments, Linux, Windows, and OS/400. Of the more than 50 other Tivoli products in the Tivoli "availability" family, those that address monitoring of key application infrastructure components for data management, messaging, collaboration, transaction processing, Web infrastructure, and application servers all support Linux. Consequently, the case can be made that IBM's support for application deployment is very comprehensive.

COMPLEMENTARY SUPPORT FOR DEVELOPERS AND ISVS

Developer Support

IBM is engaged in a variety of activities geared at sponsoring the advancement of open source software. Three notable activities are IBM's Linux Technology Center, IBM support for open source software (Cloudscape and PHP support), and Chiphopper.

IBM's Linux Technology Center

IBM is an important sponsor of open source software. The mission of IBM's Linux Technology Center (LTC) is to work directly with the Linux development community to make Linux successful as an operating system and as the basis for enterprise-class solutions. LTC employs over 600 developers and distinguished members, such as Bill Abt, Steve Best, Richard Ferri, Brian Finley, Daniel Frye, Sheila Harnett, Richard Moore, and Mark VanderWiele.

A proof point that confirms IBM's contributions to Linux and open source software can be found in IDC's 2004 *Open Source Survey*. This North American survey of 617 business and IT professionals asked respondents which vendors contributed content and/or resources to open source software initiatives. IBM was identified more frequently as a contributor than any other vendor.

Cloudscape and PHP Support

The Cloudscape product is a carryover from IBM's acquisition of Informix. Cloudscape is a pure Java, open source–based, fully transactional RDBMS that can be embedded in Java programs. A key attribute of Cloudscape is its small footprint (2MB), which enables it to easily run inside server applications, desktop applications, or Java-enabled devices. IBM contributed Cloudscape to the Apache Software Foundation (Derby project), which will oversee its continuing development. IBM will snapshot the Derby code periodically, continue to distribute it under the Cloudscape name, and provide product support.

Early in 2005, IBM also reached an agreement with Zend Technologies, which provides product and services for developers of PHP applications. As a result of this agreement, Zend has created a version of PHP (based on PHP 5), the "Zend Core for IBM," which includes a full Cloudscape database server and drivers for the DB2 family of relational database products. PHP's popularity as a Web scripting language is undeniable, and Zend has forged similar agreements with other leading RDBMS vendors to further build PHP mindshare.

IBM's current open source efforts revolve around Linux, Cloudscape, PHP, and Eclipse. This represents a very good starting point for developers who are interested in creating high-performance Web-based applications with minimum effort. By also including DB2 drivers in the Zend Core for IBM, developers who run beyond the design point of Cloudscape have an upward migration path, although license fees do apply.

Apache Geronimo and IBM Gluecode Acquisition

Based on core open source technology from the Apache Geronimo application server, Gluecode's software and related subscription support services provide a flexible and affordable infrastructure to organizations that need a reliable alternative to traditional commercial software offerings. Gluecode helps Java developers, small and mid-sized businesses (SMB) and departmental users reduce the complexity of application development by pre-integrating the most common services for building mainstream Java applications.

Gluecode offers a light-weight, customizable application server for deployment of a single application with low transaction volumes. Mostly attractive for developers is the fact that it provides an inexpensive development phase application server that is easy to migrate to/from, an application server that is easy to embed with small footprint with no upfront costs, no hassle acquisition, development and deployment. Smart, readily available assistance is derived from practical "hands-on" experience from a team that regularly collaborates with a community of like-minded developers interested in innovative technology.

IBM's WebSphere Gluecode acquisition is consistent with other similar efforts around building WebSphere on Apache and also with Linux, Eclipse, and Cloudscape. Developers can enjoy J2EE and opt for packaging and support services as they need as they expand their applications. Gluecode is available for Linux and Windows environments. For those customers that want to move to the high end over time while enjoying the Linux benefits, WebSphere offers other assets for process application integration supported in a variety of Linux environments.

Chiphopper

Chiphopper is viewed by IBM as an innovative no-charge offering that is designed to port/rehost x86-based Linux applications to POWER and/or zSeries systems and IBM middleware, including DB2 and WebSphere. The value of this offering is the ability for x86-based ISVs to target a variety of additional market segments. Chiphopper also offers an IBM post-port assurance, which means that IBM will address any issues that result from the porting. Another benefit is that Chiphopper does not require ISVs to have extensive experience in POWER or zSeries prior to initial go-to-market efforts. As a result, ISVs can be quickly responsive to a class of customer needs that would otherwise have been out of reach. Chiphopper came online in February 2005 and has already been used by over 100 ISVs without much promotion from IBM. ISVs report that the process is easy and accurate. The result is that ISVs now have more market opportunity beyond the Wintel and Lintel markets. IBM also provides a similar program for Solaris-to-Linux migration, the IBM Solaris-to-Linux Migration Factory

IBM Partnering and Developer Activities

IBM PartnerWorld

PartnerWorld is the overall business partner program from IBM and is designed to help ISVs, consultants, integrators, and resellers better understand IBM products and go to market more effectively. Within this program, PartnerWorld Industry Networks program offers incremental industry-tailored benefits to ISVs who want to build their vertical market capabilities and attract potential customers in the markets they serve worldwide. This includes support for business planning, technical capabilities, marketing, and collaboration with IBM sales and IBM business partners.

PartnerWorld offers three levels of participation:

- **Member.** The Member level is open to anyone and provides benefits that include business planning support, solution building support, go-to-market support, and networking support that promote collaboration with other ISVs.

- **Advanced.** The Advanced level is designed to support members who have demonstrated that they are maintaining a valued business relationship with IBM. Criteria for achieving the Advanced level includes demonstrating that a solution has been successfully implemented at a customer site running on IBM hardware and middleware. The Advanced Industry Optimized level exists for those members who are able to provide a customer reference and demonstrate either a solution implemented on a second IBM middleware product or a solution running on Linux. IBM recently added the Linux alternative due to the importance of Linux as a key platform for application deployment.

- **Premier.** The Premier level is designed to support members who have made a very significant commitment to IBM by engaging in joint planning and development of a relationship that has achieved market success. Premier-level participation is by invitation only.

Given the importance of Linux to markets such as finance and healthcare, IBM has invested specifically in the following three areas to help its business partners across vertical markets be successful with Linux:

- IBM has created a series of research papers for numerous key vertical industries that details success stories regarding how Linux factors into each industry and identifies various approaches for partners to leverage Linux.

- IBM, through its valued loaner program, will help ISVs get up and running on the Linux platform in under two hours. IBM is now offering this program across all product and server lines.

- Advanced- and Premier-level ISVs obtain IBM sales support in person for qualified leads within 24 hours. This program includes ISVs that are deploying on Linux. IBM's commitment to provide "feet on the street" support to ISV partners of virtually any size represents the vendor's strong desire to make its partners successful.

IBM is therefore making a concerted effort to promote Linux across all of its partner programs and vertical industries.

Open Source Software Initiatives in DeveloperWorks

DeveloperWorks is the focal point from IBM for technical resources to support professional developers. DeveloperWorks offers tools, code, and education across all of the software products that IBM supports. IBM devotes a significant amount of DeveloperWorks real estate to subject areas that are important to developers. DeveloperWorks heavily features not only Linux and open source but also Java, SOA, XML, wireless, and grid. IBM realizes that its ability to build loyalty in the developer community depends on its ability to make developers successful. Therefore, much of DeveloperWorks is devoted to ensuring that developers can understand the role of key technologies today and the relationship of these key technologies to IBM products.

CHALLENGES AND OPPORTUNITIES

IBM provides an unparalleled level of product IT life-cycle management coverage across all of the leading operating environments. IBM has achieved this level of product functionality through a combination of ongoing product development, acquisitions, and partnering. However, the rapid rate of change means that product integration is a key priority. The recent "Atlantic" release of the Rational products was a considerable achievement, and it also marked the first time that many of the products were truly integrated with each other despite prior IBM claims. As additional dimensionality, such as business process automation, business rules, and event-driven architectures, is woven into the software development life cycle, IBM will continue to be challenged to address integration demands not only within and across its brands but also with its business partners.

With hundreds of internal software products and thousands of partner products, IBM must rise to the challenge in a fair, consistent, and carefully orchestrated way in order to preserve order within its ecosystem. Standards and integration frameworks will undoubtedly factor heavily into IBM's future, much like Eclipse did for development tools. IBM's continuing challenge is to maintain its role as perhaps the strongest unifying force in the software industry today and at the same time retain its leading position in open source software and its development of open standards and frameworks for focusing on and simplifying the increasing complexity that accompanies IT today.

CONCLUSION

Software development, software applications, and IT operations are now core activities that differentiate business performance. Consequently, the choice of tools and technologies to enable application development has a tremendous impact on the quality and utility of the software applications that they create and contributes to the performance of the application when deployed into a production environment. Therefore, access to and the availability of an end-to-end tool for software development, deployment, and operation are critical today. IBM is one of the few

vendors that offers a complete and comprehensive set of products across all of the leading operating environments.

Although significant IBM commitment to Linux became visible in the late 1990s, these contributions have accelerated greatly in the past several years. Several key events enabled IBM to firmly stand behind Linux and Linux-based development:

- Linux obtained tier 1 status as an operating environment within IBM and therefore requires the same level of attention and product support as z/OS, AIX, and other tier 1 operating environments.

- The acquisition of Rational Software provided IBM with many of the most successful application life-cycle, design, development, and testing tools in the market.

- Eclipse provided IBM with a unifying framework for IBM's development tools and a consistent way for third-party tools to complement IBM's products.

The result of these three events is that IBM has emerged as an unparalleled provider of application development and deployment tools while simultaneously extending these development and deployment capabilities to Linux. IBM's decision to "open source" the Eclipse platform as well as level the playing field for Eclipse plug-ins is a strategy that many third-party vendors and Java developers find compelling.

TO LEARN MORE

- Check out the IBM Rational Software Development Platform for Linux page: **www.ibm.com/rational/linux/**

  Rational software offers a comprehensive solution that allows developers to leverage Linux to build, integrate, expand, modernize, and deploy software. With broad support for all roles and activities in the software life cycle, the IBM Rational Software Development Platform supports development on as well as development for Linux.

- IBM Software Evaluation Kit (SEK) for Linux and Technical Resources: **www.ibm.com/developerworks/offers/linux-speed-start**

  Get evaluation products from DB2®, Lotus®, Rational®, Tivoli®, and WebSphere® and start building applications and deploying them on IBM middleware. Select the Linux™ version of the no-charge SEK.

- Check out the IBM Rational Software Development Platform for Linux white paper: **www3.software.ibm.com/ibmdl/pub/software/rational/web/whitepapers/G507-1031-01_Linux_SDP.pdf**

  Rational software offers a comprehensive solution that allows developers to leverage Linux to build, integrate, expand, modernize, and deploy software. With broad support for all roles and activities in the software life cycle, the IBM

Rational Software Development Platform supports development on as well as development for Linux.

CASE STUDY: RATIONAL AND CHIPHOPPER DELIVERS PRODUCTIVITY AND REAL VALUE TO ROCKET SOFTWARE

Rocket Software, a provider of enterprise management solutions including business intelligence (BI) tools and executive dashboard tools to Fortune 100 companies, recognized there was significant value in deploying its software solutions on IBM's pSeries, zSeries and iSeries Linux-based enterprise servers. The company believed this move would enable it to provide its customers with a significantly improved distributed environment that was more robust, scalable, and cost effective.

Since many of its products are deployed on the IBM infrastructure, Rocket Software developers use the IBM Rational Application Developer suite on Linux for most of their development needs. Peter Richardson, the Business Unit Manager responsible for the business intelligence business unit at Rocket Software believes that apart from their exceptional productivity, one of the key advantages of the IBM Rational tools is their tight integration with other IBM infrastructure, such as DB2 and the WebSphere platform, providing a full-featured product development and test environment within a single toolset. He also believes that IBM Rational Application Developer contains a number of productivity tools that Eclipse alone doesn't provide.

Rocket Software expected there would be an increased migration toward Linux on enterprise servers and wanted to quickly meet their customers' requirements for solutions on this platform. Rocket Software had observed that many of its Rocket Visionary customers were already moving from Windows to Linux, because they perceived Linux to be a more compelling offering with good economic performance, scalability, and reliability. Since Linux was increasingly being accepted within enterprises, Rocket Software anticipated the demand for Linux would continue to grow. Having already moved their 3-tier BI solution to Linux running on x86 platform, the company was interested in finding tools that could help them with the remaining ports.

Using IBM's Chiphopper, Rocket Software was able to achieve a successful port of its server based infrastructure to Linux on the pSeries, iSeries, and zSeries platforms more quickly than it could have accomplished using its own tools and internal resources. Through the Chiphopper program, the company had exclusive and free access to dedicated IBM hardware running all the hardware platforms and specific versions of Linux they were targeting. Peter Richardson said he felt as if IBM was providing Rocket Software with an external unlimited IT group that was dedicated to serve them as they tested and debugged their product line. IBM managed and took care of all the resources Rocket Software required. IBM gave them a "killer" test environment to work with. Developers just defined what they required and IBM delivered the specific configuration a day or two later. This allowed Rocket Software to do their testing quickly and easily.

IBM provided priority support for any issues that arose with the IBM infrastructure throughout Rocket Software's project. More importantly, IBM put dedicated resources at their disposal and provided rapid response and rapid access to their support personnel. Rocket Software was given a single point of contact who coordinated the various IBM teams required to deliver the specific combinations and versions of software and hardware required by the development teams. Richardson said, "IBM provided excellent support for all our needs in the Chiphopper program."

Every port went smoothly and Rocket Software had full access to everything it required from IBM. Compared to doing the same thing manually, the company estimates it would have taken twice as long to complete the project using their own resources and another approach. More to the point, Rocket Software would have had to pull resources off of other projects to complete the port without Chiphopper.

One final surprising benefit was how quickly the company was able to complete each project. Linux proved to be a consistent environment on the 3 IBM platforms targeted by Rocket Software and its developers were able to concentrate entirely on the development issues without worrying about the infrastructure. This allowed each project to be completed quickly. Rocket Software is also pleased that it gets to display the 'Ready for IBM eServer with Linux' logo validating that Rocket Software fully leverages IBM's enterprise-class servers.

Richardson believes that IBM's Chiphopper is a very valuable service that offers tremendous value to organizations. He also believes that another advantage is that this program gives companies access to IBM hardware companies might not have in-house. Richardson would absolutely recommend Chiphopper to any company requiring help with their Linux on IBM ports.

CASE STUDY: CHIPHOPPER SIMPLIFIES THE PORTING AND TESTING OF AVOKIA'S RESOURCE OPTIMIZATION SOLUTIONS

Avokia is a provider of resource optimization solutions that run on Linux and includes ApSuite, an application performance solution that enables high availability and fast disaster recovery. Avokia's software products address the requirements for mission critical environments by providing high availability and disaster recovery solutions. This capability has traditionally been implemented for the most mission critical tier-1 applications. Frankie Wong, founder, chief architect, and currently CTO of Avokia believes that all applications could utilize and benefit from this type of technology, if the solutions were more cost effective, and could be configured with minimal overhead and management. Consequently he is targeting his company's products to those tier-2 mission critical applications that are either not already protected by expensive hardware redundancy and hardened infrastructures, or have been moved to Linux platforms.

Frankie Wong selected Linux because it enables the company to implement the desired functionality and capability of their software solution cost effectively on a robust, scalable, and affordable platform. He also expects this customer base to grow much faster than the tier-1 application market in the future.

Avokia's software is developed in Java using the Eclipse framework and a Windows development environment. The company also works with IBM Rational Application Developer as well as DB2 and Websphere Application Server. While the developers work with other databases, they prefer DB2 because they found it was easier to set up, required less hardware, and had a smaller footprint.

Avokia was selected by IBM to participate in its pilot Chiphopper program. Avokia used IBM's Chiphopper to test the different code ports it was developing. Many types of hardware platforms run different versions of Linux and there are slight differences in each version and variant of Linux as well as between the different platforms. All of the Avokia products must be properly configured to run on each specific version of Linux and IBM eSeries, pSeries, iSeries, and zSeries platforms.

Initially the company used the Chiphopper program to test its software ports to IBM's Websphere and DB2 products. IBM's program brought Avokia significant value in that it provided an ideal platform to help the company meet its needs. The program enabled Avokia to develop their software and test it on zSeries and other IBM hardware.

The initial project was completed in about one month. However Avokia would have spent considerably more time and money doing the testing had they not had access to Chiphopper. They would have had to rent time on the zSeries systems at a cost in excess of $30,000 and would have had to find and debug problems using their own internal resources. Since everything went so smoothly with the first project, the company decided to continue to use Chiphopper to test its product's ability to synchronize databases running on the same four platforms all networked together.

Having had experience with leveraging other IBM services and programs when testing their own products on IBM hardware, Frankie Wong expected Chiphopper would be a variation of other IBM programs he had previously used. He expected IBM to supply hardware, but didn't expect that IBM would provide the support to help to port the code to its own platforms. He didn't expect that IBM would debug their problems on the IBM platforms or quickly provide every configuration they required. And he didn't expect IBM to be nearly as responsive as it was to his needs. Whenever Avokia asked for resources, it received them.

Frankie Wong said the entire process was very smooth and IBM was ready to help whenever it was required. He believes Chiphopper is the most complete and well-packaged program of its kind that he has ever seen. He also is pleased that he can tell his customers that not only can Avokia support their databases on their current hardware but Avokia can also support and synchronize their database across other IBM platforms as well. This capability along with the ability to use the IBM 'Ready for IBM eServer with Linux' logo opens up new revenue opportunities for the company.

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