Cloud-Based Java Development:
Choosing the Right PaaS

How five popular platforms stack up for today’s and tomorrow’s workloads.

SEPTEMBER 2015
AN EXCLUSIVE RESEARCH REPORT IN ASSOCIATION WITH eWEEK
SPONSORED BY: ORACLE
Contents

3 Executive Summary
4 Full Java Platform Stack
9 Scalability
10 Fit with Current Skills
10 Application Portability/Integration with Third-Party Tools
10 Security and Identity Services
11 Cost and TCO/ROI
11 Summary
12 Appendix
Executive Summary

Enterprises are increasingly looking to platform as a service (PaaS) to lower their costs and speed their time to market for new applications. Developing, deploying and managing applications in the cloud eliminates the time and expense of managing a physical infrastructure to support them.

PaaS offerings must, however, deliver long-term benefits beyond lowering the per-month cost of a development server. Today’s platform offerings must also offer a lower total cost of ownership (TCO), enable rapid scalability and ease integration while providing robust security and availability.

Based on interviews with leading analysts, reviews of user feedback, published reports and information from cloud providers, we evaluated five top pure-play PaaS providers and their platforms for this report: Amazon Web Services (AWS) Elastic Beanstalk; IBM Bluemix; Microsoft Azure; Oracle Cloud Platform; and Red Hat OpenShift. Many players could be defined as “PaaS vendors”—including SalesForce.com and Heroku—but we focused on those that offer the most integrated, standards-based Java solutions to enterprise customers.

WE LOOKED CLOSELY AT THE FOLLOWING AREAS:
• Support for a full Java development stack, including middleware, database and collaboration platforms.
• Agility and scalability using automated infrastructure and database provisioning and management.
• Ability to leverage current staff skills.
• Database and application portability and integration with third-party tools.
• Security and identity services.
• TCO and return on investment (ROI) of the complete PaaS solution.

WE FOUND:
• AWS and Microsoft, being the earliest to market, are currently popular platforms for customer-facing Web or mobile Java SE apps typically deployed in the cloud today.
• Oracle has the most complete and best-integrated set of services. These include multiple services supporting Java, not only for mobile or Web Java SE apps but also for the enterprise-critical transactional applications expected to move to the cloud in the near future. Not surprisingly, the Oracle Cloud is strong for Oracle Database and Oracle Application users, while its support for non-Oracle databases is still evolving.
• IBM has potential to leverage its legacy technology in areas such as databases and middleware, but it is relatively new to PaaS and has yet to deliver on or prove some capabilities.
• Red Hat offers a wide range of development tools, but its reliance on AWS for its supporting infrastructure may limit its enterprise-class capabilities and make management more complex and costly.

Beyond these high-level findings, each organization must weigh its specific needs against the strengths and challenges of each PaaS offering, which we detail below.

Organizations also should consider that our findings may be outdated quickly. Given the rapid pace of innovation by all the PaaS vendors, specific features and offers may have changed during the time this report was researched, written and published.
## Figure 1: Support for Full Java Stack

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Challenges</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amazon</strong></td>
<td>• Not as well integrated as other PaaS offerings</td>
<td>• API links to Watson cognitive computing are a potential differentiator.</td>
</tr>
<tr>
<td>• Solid IaaS foundation</td>
<td>• Lack of unified management across its IaaS and PaaS levels and across private and public clouds</td>
<td></td>
</tr>
<tr>
<td>• Proven system management tools</td>
<td>• Could increase management costs and make it more difficult to assure required service levels</td>
<td></td>
</tr>
<tr>
<td>• Support for a wide range of databases</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IBM</strong></td>
<td>• Not compatible with Java EE6</td>
<td></td>
</tr>
<tr>
<td>• Proven IDEs, middleware, databases and administration tools</td>
<td>• Some apps built for IBM WebSphere cannot run on its Bluemix PaaS</td>
<td></td>
</tr>
<tr>
<td>• Based on popular open-source Cloud Foundry framework</td>
<td>• Still integrating legacy tools with Bluemix</td>
<td></td>
</tr>
<tr>
<td><strong>Microsoft</strong></td>
<td>• Forces developers to manually create their own Java servers, unlike its more automated provisioning of servers using Microsoft's own .NET framework</td>
<td></td>
</tr>
<tr>
<td>• Deep bench of popular development and system administration tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Includes database, middleware, data grid and mobile services</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oracle</strong></td>
<td>• Strongest support for Oracle Database; evolving levels of support for others (see below)</td>
<td></td>
</tr>
<tr>
<td>• Well-integrated cloud services, including cloud tooling, to automate management and reduce operating expenses</td>
<td>• Still developing support for Windows-based platforms</td>
<td></td>
</tr>
<tr>
<td>• Industry-leading database with enterprise levels of performance, security and availability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strong SaaS offerings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strong Java support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Offers full portability across both public and on-premises private clouds with no changes required to architecture, code or skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Red Hat</strong></td>
<td>• Lacks a dedicated IaaS</td>
<td></td>
</tr>
<tr>
<td>• Supports a wide variety of application servers, such as Tomcat and JBoss, and a variety of IDEs</td>
<td>• Will strength of its open-source development community compensate for its limited R&amp;D budget?</td>
<td></td>
</tr>
<tr>
<td>• Fullest support for Red Hat’s popular JBoss Application Server</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is integrating its PaaS, IaaS and hybrid cloud management offerings in Red Hat Cloud Suite for Applications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### FULL JAVA PLATFORM STACK

Companies looking to develop and deploy Java applications in the cloud need a full set of capabilities to manage not only application code but also databases and the connections among the multiple systems to which cloud applications must connect. Such an integrated software stack should include development languages, as well as the databases, middleware, code repositories, and collaboration and management tools required to develop, deploy, manage and secure Java applications (see Figure 1, “Support for Full Java Stack,” at left).

The importance of offering a complete set of capabilities was shown by analysis and business strategy firm Enterprise Strategy Group (ESG) in a November 2014 survey of more than 300 senior developers and IT managers that focused on what PaaS capabilities they cared about most. PaaS adoption favors vendors with longstanding application development and deployment track records. The leaders in PaaS adoption were Microsoft (Azure) and IBM (Bluemix). There is perceived value in PaaS and infrastructure as a service (IaaS) synergy.

PaaS adoption shows a unique bifurcation of vendors. This division is best characterized by whether the vendor also provides native IaaS capabilities. The leading five PaaS vendors include Microsoft, IBM, Google, Oracle and Amazon, all of which provide native PaaS and IaaS capabilities. These vendors excel at providing PaaS environments that support custom application development and the subsequent transition of applications from development into production. Because PaaS is primarily focused on building custom mission-critical applications, these applications also require high levels of reliability, availability, scalability and manageability once they are in production.

### Development tools

All five vendors scored well on their support for 3GL tools now used by many developers, says Stephen D. Hendrick, principal analyst with the Enterprise Strategy Group.

Although Microsoft’s development offerings are focused on those organizations using its own .NET framework, it “has also built strong bridges to the non-Microsoft developer community through solid support for Linux,
open-source tools and middleware,” according to “The Forrester Wave: Enterprise Public Cloud Platforms, Q4 2014.”2 Azure “lacks the maturity and breadth of capabilities and controls of AWS,” continued the report, but it delivers strong services for video, big data, mobility and integration with Microsoft applications.

**Oracle** supports Java, JavaScript and other Java-based scripting languages, as well as the generic Java SE and the Node.JS platforms for building data-intensive real-time applications that run across distributed devices. **Oracle** also offers Application Express (APEX), which enables users to design, develop and deploy database-driven applications using only a Web browser.

**Databases.** With the volume, variety and velocity of enterprise data soaring, developers need access to a variety of data management solutions. Organizations need to consider not only the range of databases a PaaS provides but also the cost to manage those database services and how well integrated they are with the rest of its development ecosystem. Those companies with a wide variety of enterprise database types to support will naturally have different requirements than those with just a few.

In this regard, **Amazon’s** Relational Database Service supports **Oracle**, as well as MySQL, Microsoft SQL Server, PostgreSQL and its own Amazon Aurora. Similarly, **Red Hat** supports MySQL, MongoDB, PostgreSQL and phpMyAdmin.

**IBM** supports a SQL Database service based on its DB2, as well as the IBM Cloudant NoSQL JSON document store, MySQL, MongoDB and PostgreSQL. Meanwhile **Oracle’s** Database Cloud Service, not surprisingly, provides full instances of its Oracle Database. This service enables a rapid development environment within minutes, avoiding the traditional cost and effort of deploying a full database instance. Other Oracle services support Hadoop and Oracle NoSQL.


---


---

**Figure 2: Scalability**

<table>
<thead>
<tr>
<th></th>
<th>Strengths</th>
<th>Challenges</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Amazon | • Mature IaaS foundation  
• Very strong, proven scalability  
• Many developers and admins are already familiar with the management tools needed for scaling | • Unintuitive manual processes can require help from Amazon in scaling applications  
• Risk of outages due to errors in allocating resources across availability zones |          |
| IBM   | • Supports scale-up and scale-out  
• Allows network customization such as uplink upgrades and load balancing among datacenters  
• Optional autoscaling | • Managing scalability requires multiple tools from IBM and partners  
• Still early in scaling its IaaS offerings |          |
| Microsoft | • Proven massive scalability | • Autoscaling not available at all price tiers |          |
| Oracle | • Easy, zero-downtime scalability for the entire infrastructure stack, from application to database  
• APIs provide not just scalability but also data such as run status and CPU and memory usage  
• Exadata Service provides a highly scalable mission-critical platform for data management | • Base IaaS, with growing services |          |
| Red Hat | • Elastic scaling for ease of ramping infrastructure up and down  
|         | • Runs on AWS, requiring separate tools (and thus more cost and complexity) to manage scalability | |          |
Oracle offers Exadata engineered system solutions for mission-critical databases and applications, as well as a schema-based multitenant service targeted at development in smaller environments.

**Mobile development tools.** The need to speed mobile applications to market is a major driver of PaaS today, according to analysts. Hoping to leverage mobility to its advantage, IBM prominently features its MobileFirst Platform for building iOS and Android applications. IBM also offers its mobile backend in the form of service offerings such as data storage and user management.

With Windows 10 Mobile and Silverlight still commanding large numbers of developers, ESG's Hendrick says Microsoft is improving its position in the mobile space. Its tools “will serve as a perfect springboard as Microsoft transitions to their Universal Windows Platform (UWP) which is part of Windows 10,” he says. UWP also includes software development kits for Android/Java, iOS/Objective C and—eventually—.NET/Win32. This support will enable such applications to run on Windows 10 with minimal modification and leverage other new services. Hendrick calls this “a very significant move” that boosts Microsoft’s ability to become “a leading force in mobile development.”

He cautions, though, that “the mobile development tools market is highly fragmented with many great products” and that many enterprises have already chosen their mobile development tools. This reality, Hendricks says, makes it “difficult for PaaS vendors who may provide new or different capabilities to easily gain traction.”

Oracle’s Mobile Cloud Service includes a development framework that enables developers to define mobile interfaces and application programming interfaces (APIs). The framework also provides enterprise data connections and back-end services. According to IDC in its January 2015 report, “Platform as a Service: Empowering Digital Transformation”3, Oracle’s Mobile Application Framework provides cross-platform mobile app development for iOS and Android through a hybrid mobile architecture that leverages HTML5, JavaScript and Java.
CLOUD-BASED JAVA DEVELOPMENT
Five Popular Platforms

Several analysts saw Red Hat’s OpenShift somewhat behind the other vendors in delivering mobile development services. However, they point to the company’s 2014 acquisition of mobile application platform provider FeedHenry as an important step forward.

Middleware. Integration with back-end systems is especially important as many of the applications organizations are developing in the cloud are new customer-facing systems that rely on older on-premises systems for data such as customer purchase or service histories. Equally important is the ability of a PaaS to support easy, and even continuous, deployment and integration of new code. IBM, Oracle and Microsoft have each spent decades developing (or acquiring) such middleware. But each supplier has moved at varying speeds to bring these capabilities to its PaaS platforms.

IBM says the middleware services in Bluemix act “on the application’s behalf when it provisions new service instances, and then binds those services to the application.” However, IBM’s Bluemix and its application services are “new and relatively untested” and it is still attracting partners to support it, according to Forrester’s Q4 2014 Wave report. For its part, Red Hat’s OpenShift Cartridge system lets developers add other language, database or middleware components to support the needs of specific applications.

**Figure 4: Security**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Challenges</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amazon</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Supports private subnets and end-to-end encryption</td>
<td>• May require use of third-party products such as firewalls for maximum effectiveness</td>
<td></td>
</tr>
<tr>
<td>• Optional VLAN connections</td>
<td>• Lack of on-premises, private cloud options for sensitive data</td>
<td></td>
</tr>
<tr>
<td>• Option for Perfect Forward Secrecy, using ephemeral session keys that are more difficult to break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Support for multifactor authentication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strong access control</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IBM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Each application is isolated in its own container with resource limits</td>
<td>• Only some plans provide specialized reports, such as which users accessed a database within certain periods or who accessed sensitive data</td>
<td></td>
</tr>
<tr>
<td>• Bluemix relies on the network-within-a-network topology of SoftLayer for physical network security. This architecture ensures that systems are fully accessible only to authorized personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Uses SoftLayer network-within-a-network to isolate public and private traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strong access control</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Microsoft</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Leverages Microsoft’s Security Development Lifecycle and Security Response Center</td>
<td>• Recently announced enhancements to its security services using its Key Vault secure key management for encryption-at-REST and securing passwords and other secrets.</td>
<td></td>
</tr>
<tr>
<td>• Lets customers federate user identities to Azure Active Directory and enable multifactor authentication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Provides VPNs for links to on-premises resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oracle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Prevents environment sharing between tenants</td>
<td>• Database services users can control access to specific pages, individual items or report columns based on user identity.</td>
<td></td>
</tr>
<tr>
<td>• Out-of-the-box identity management with single sign-on between Oracle SaaS apps and customers’ extensions to them</td>
<td>• Users can limit access to specific RESTful Web Services based on the application making the request, the identity of the user or the values within the data itself.</td>
<td></td>
</tr>
<tr>
<td>• Includes self-service user management and access control tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• All Enterprise versions of the Oracle Database Cloud Services include transparent data encryption (TDE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Red Hat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strong background in Security Enhanced Linux (SELinux)</td>
<td>• Each application or database runs within its own Linux container equipped with security features of SELinux.</td>
<td></td>
</tr>
<tr>
<td>• Provides ongoing security reviews and enhancements from open-source community</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Expertise with Docker containers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Out-of-the-box “connectors” play a big role in Oracle’s middleware strategy. According to IDC’s “Platform as a Service” white paper, Oracle’s Integration Cloud Service uses connectors to integrate on-premises apps, Oracle Cloud and third-party software as a service (SaaS). Oracle’s integration portfolio—namely, Oracle SOA Suite, SOA Cloud Service, Data Integration Suite and Integration Cloud Service—supports a wide variety of integration types, applications, services, data and events. In addition, it supports multiple protocols, including Web services such as simple object access protocol (SOAP) and representational state transfer (REST).

Application and infrastructure management. With applications running on an ever-wider mix of on-premises and cloud platforms, enterprises need easier to use tools for everything from deployment to performance monitoring, reporting, troubleshooting and analytics. To provide these capabilities, Microsoft is building on its System Center software and Oracle is refining its Enterprise Manager for use in PaaS environments, while IBM works to integrate its underlying SoftLayer open-source platform with its Bluemix PaaS.

Oracle stands out from competitors in the ease with which administrators can automatically create Oracle Database instances, provision the underlying compute and storage infrastructure, and deploy Java Enterprise Edition (EE) servers, a key step in the application deployment process, says John Rymer, vice president and principal analyst at technology and market research company Forrester Research. Oracle’s support for this capability is important, he says, because Java EE is so widely used for the types of transactional workloads Forrester expects to increasingly move to the cloud.

Overall, he says, Oracle Java Cloud Services provides more tightly integrated tooling than most cloud platform competitors for the development, deployment and ongoing management and updating of database applications.

Finally, Red Hat’s reliance on Amazon for underlying infrastructure requires enterprises to use a wider variety of management tools, possibly increasing management costs.
CLOUD-BASED JAVA DEVELOPMENT

Five Popular Platforms

**Tooling integration/project tracking/version control.** Most vendors support industry standards and popular tools for development integration, project tracking and version control, such as Git, Jenkins and Maven. All vendors also support popular integrated development environments such as Eclipse and NetBeans. In general, organizations should carefully evaluate whether a potential PaaS vendor supports the specific tools in which their staffs are skilled.

**Microsoft,** for example, allows developers to use its own Team Foundation Version Control for centralized version control or the open-source Git for a distributed approach. They can also access projects, code and work items within Visual Studio or through a plug-in for the rival Eclipse integrated development environment (IDE). Similarly, **Oracle** provides rich integration with both Maven and Ant for project management and build.

**Red Hat** supports Jenkins for continuous integration, Maven for build management and the Wercker continuous delivery platform, among others.

**IBM** offers plug-ins that help integrate existing Eclipse environments with its Bluemix PaaS and provides hosted Jenkins implementations through its IBM DevOps Service for Bluemix. Among other features, it allows Bluemix users to link their projects to GitHub's collaboration, code review and code management platform.

**Amazon** provides its own AWS CodeDeploy to automate code deployments to Amazon EC2 instances. It also offers third-party continuous integration tools, such as Jenkins, hosted on AWS.

**SCALABILITY**

As mobile devices drive up the number of users, and big data accelerates the amount of information under management, enterprises increasingly need to automatically scale their infrastructure to meet spikes or drops in demand.

“Cloud providers, by their nature, are intrinsically able to adapt to unforeseen demands because new instances and storage are always mere seconds away,” says Stephen O’Grady, principal analyst and cofounder of industry analyst firm RedMonk. “The challenge is in automating the process of scaling to meet unforeseen demands. Here, every vendor is still working on their ability to deliver frictionless, hands-off scalability to non-trivial, production-class workloads” (see Figure 2, Scalability,” on page 5).

Built on the SoftLayer IaaS it acquired in 2013, **IBM** allows customers to customize their networks “with uplink upgrades, load balancing within or between datacenters and software-defined networking appliances that protect and optimize performance,” he says. **Microsoft** claims its asynchronous messaging helps provide consistent performance for cloud resources such as SQL Azure, Azure Storage and Azure Websites. This technology, claims **Microsoft,** ensures “smooth operation under heavy and variable load with the durability to survive intermittent failures.” Finally, **Amazon’s** free Elastic Beanstalk service includes capacity provisioning and load balancing.

---

**Figure 6: Use Cases for Various PaaS Providers**

<table>
<thead>
<tr>
<th>Platform</th>
<th>Suggested Use Cases</th>
</tr>
</thead>
</table>
| **Amazon Elastic Beanstalk** | • Organizations with strong DevOps skills  
• Organizations experienced with Amazon’s IaaS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| **IBM Bluemix**            | • “Coders” who want to focus on development rather than configuring the underlying infrastructure, as well as DevOps pros  
• Applications leveraging IBM’s DB2 database, its established middleware options or its emerging Watson analytics capabilities                                                                                                                                                                                                                                                                                                                                                     |
| **Microsoft Azure**        | • Coders who want to focus on development rather than configuring the underlying infrastructure; DevOps and Microsoft .NET shops  
• Customers seeking an integrated, Microsoft-centric development, deployment and management environment                                                                                                                                                                                                                                                                                                                                                                               |
| **Oracle Cloud Platform**  | • Java-focused development organizations  
• Organizations/developers experienced in applications that leverage Oracle Database, Fusion Middleware and Cloud Management offerings  
• Customers needing to extend Oracle’s SaaS offerings or link other applications to them  
• Customers requiring hybrid (public and private) cloud management and portability                                                                                                                                                                                                                                                                                                                                                                                      |
| **Red Hat OpenShift**      | • Organizations that want maximum portability among cloud and on-premises platforms  
• Enterprises skilled in, and comfortable with, the use of open-source platforms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
CLOUD-BASED JAVA DEVELOPMENT
Five Popular Platforms

FIT WITH CURRENT SKILLS
Given the high cost and delays of retraining staff, developers and their employers naturally look for PaaS offerings that enable them to use as many of their current skills as possible. Although the quality of the fit obviously depends on the customer’s current skill set, says Redmonk’s O’Grady, Microsoft, Oracle, and Red Hat are among those “adept at delivering solutions that are accessible to their existing customer base.” A lot of the growth behind AWS, he says, “comes from newer users less focused on traditional middleware and more on modern alternatives.”

Oracle aims to reduce retraining needs with an improved version of its existing WebLogic Server Administration Console and its support for standard IDEs. Additionally, its ability to integrate with most third-party Java frameworks, such as Hibernate and Spring, enables teams skilled in these popular tools to continue using them, says Michael Salinger, director of Platform Engineering at mobile back-end as a service provider Kinvey.

APPLICATION PORTABILITY/INTEGRATION WITH THIRD-PARTY TOOLS
Most developers today want the option to run applications on whatever mix of on-premises datacenters and off-premises clouds that delivers the best combination of performance, cost and security. They also need to link applications running in the cloud to tools that provide everything from application development to deployment and management, as well as to databases and other capabilities provided as Web services.

The vendors we reviewed are working to meet these portability needs with everything from prebuilt integration with Web services to RESTful APIs. RESTful APIs offer simpler and easier development and deployment of distributed applications than earlier service-oriented architectures (SOAs) (see Figure 3, “Portability and Integration,” on page 6).

IDC’s “Platform as a Service” white paper6 says Oracle’s use of the same standards, architecture and products in public and private clouds is a plus for enterprises looking to port workloads among hybrid public and private architectures. Its JCS-SaaS extensions enable customers to customize Oracle SaaS offerings and integrate them with other applications.

All of the vendors surveyed support the popular REST architecture to reduce the bandwidth required by distributed applications. In its “Oracle PaaS Cloud: Ambition and Expansion” report7, Ovum says Oracle’s support for RESTful Web services is part of “the transformation of Oracle’s middleware portfolio into a set of Public PaaS services.” Red Hat claims its OpenShift platform includes unmodified open-source language runtimes. As a result, Red Hat claims “applications developed on OpenShift can be easily moved to other environments supporting the same open-source languages.” Amazon lacks an on-premises option, and its ability to integrate fully with enterprise networks is limited by its less than full-featured virtual private network (VPN), says Kinvey’s Salinger.

Meanwhile, IBM recently announced an expanded suite of OpenStack services. It claims the suite will enable developers to launch applications on local, on-premises or public cloud environments hosted on its SoftLayer IaaS without changing code or configurations.

SECURITY AND IDENTITY SERVICES
To enhance their security offerings, PaaS vendors must assure their clients that applications and data can be isolated from those of other enterprise clients—and that each customer can easily manage identity and access management across applications and the PaaS components that support them.

TO ENHANCE THEIR SECURITY OFFERINGS, PaaS VENDORS MUST ASSURE THEIR CLIENTS THAT APPLICATIONS AND DATA CAN BE ISOLATED FROM THOSE OF OTHER ENTERPRISE CLIENTS—AND THAT EACH CUSTOMER CAN EASILY MANAGE IDENTITY AND ACCESS MANAGEMENT ACROSS APPLICATIONS AND THE PaaS COMPONENTS THAT SUPPORT THEM.

CLOUD-BASED JAVA DEVELOPMENT
Five Popular Platforms

today is debatable. ESG’s Hendrick says most of the PaaS vendors covered in this survey provide similar levels of support for containers, and for properly ensuring their security.

COST AND TCO/ROI
Organizations should beware of simplistic, side-by-side cost comparisons of various PaaS vendors.

It’s easy to claim the lowest costs for, say, an hour’s use of a four-core i7 CPU with 64 gigabytes of RAM or a terabyte of storage. However, the more features a customer adds, the harder the comparisons become. Different vendors include various combinations of deployment and management tools, not to mention database features, at different levels of pricing. For example, what one vendor offers in low up-front cost may be offset by higher management costs (see Figure 5, “TCO and ROI,” on page 8).

Microsoft, for example, bundles nearly “everything a developer would need” in its per-seat pricing, says Alan Krans, senior cloud analyst at analyst firm Technology Business Research. This includes compute resources, as well as a development framework with access to a community of developers for help and support. Kinvey’s Salinger notes, however, that Azure forces developers to manually create their own Java servers, unlike its more automated provisioning of servers to run applications using Microsoft’s own .NET framework.

Forrester’s Rymer says the tightly integrated continuous integration tooling in Oracle’s Java Cloud Services is a potential major cost saver, because it automates the frequently expensive work of software patches and updates. He also recommends evaluating whether a PaaS provider provides true “pay-as-you-go flexibility.” This enables organizations to increase or reduce their capacity—and their cost—as needs change, rather than committing to specific service levels beforehand. AWS and Azure provide such flexibility, says Rymer, while “the others seem to be more static,” reducing the potential for cost savings.

SUMMARY
With everything from the enabling technologies to customer needs evolving rapidly, customers face a challenging task in evaluating PaaS platforms. The most appropriate platform for any use case will depend on factors such as:
• The objectives of the application.
• The installed infrastructure and skill set in the enterprise.
• The value of speedy deployment versus long-term maintainability and scalability (see Figure 6, “Use Cases for Various PaaS Providers,” on page 9).

Before choosing a PaaS platform, organizations should consider a variety of factors, including:
• The types of applications, data sources, services and end-user devices (such as mobile platforms) on which their applications will run.
• How far these applications, and the data supporting them, will need to scale, the cost of such scaling and whether a provider enables your costs to shrink dynamically with your resource usage.
• The skills of their developers and system administrators, and how much it will cost to retrain them or acquire those skills outside to adopt new technologies.
• The supporting tools, ranging from databases to collaboration platforms, and how much it will cost to acquire them from a PaaS provider. For example, how much it will cost to purchase the needed capacity in the cloud for the specific type of database their application requires and the network costs of moving the required data to it.

Organizations should also consider:
• In what increments the PaaS provider’s prices rise, and how those compare to the customer’s expected usage.
• The performance and uptime level times, as well as the recovery point objectives and estimated recovery times promised by the vendor for PaaS offerings at various price points.
• Whether every required feature (such as autoscaling) is available at every price tier, and how adding those features will affect total price.

The information presented in this report is, to the best of our knowledge, accurate at the time of publication. Remember, these vendors are always adding new services and adjusting their pricing to compete in this fast-growing market. Enterprises should regularly revisit this list of questions, and the most current PaaS offerings, to assure they are getting the maximum agility and cost savings benefits at the lowest possible cost.

IT’S EASY TO CLAIM THE LOWEST COSTS FOR, SAY, AN HOUR’S USE OF A FOUR-CORE I7 CPU WITH 64 GIGABYTES OF RAM OR A TERABYTE OF STORAGE. HOWEVER, THE MORE FEATURES A CUSTOMER ADDS, THE HARDER THE COMPARISONS BECOME. DIFFERENT VENDORS INCLUDE VARIOUS COMBINATIONS OF DEPLOYMENT AND MANAGEMENT TOOLS, NOT TO MENTION DATABASE FEATURES, AT DIFFERENT LEVELS OF PRICING.
APPENDIX
The following sources were used in preparing this report:


Sources interviewed for this report include:


Stephen O’Grady, principal analyst and cofounder at RedMonk. www.redmonk.com

Alan Krans, senior cloud analyst at Technology Business Research. www.tbri.com

John Rymer, vice president and principal analyst at Forrester Research. www.forrester.com

Michael Salinger, director of Platform Engineering at Kinvey. www.kinvey.com