

TERRACOTTA WHITEPAPER:

Caching Use Cases in the Enterprise

What You Can Learn from Hundreds of Ehcache Users Around the Globe

Eric J. Bruno

Allure Technology, Inc
www.alluretechnology.com

I was recently involved in a series of user surveys to better understand enterprise application developers' use of Ehcache, the de facto caching standard for enterprise Java. The answers give a detailed view of how Ehcache is currently being used—and how developers and architects plan to use it in the near future—within a wide range of enterprise applications, across industries and around the world. The goal of this paper is to share this peer information and architecture with you in order to give you a better understanding of how Ehcache can help you as well. Additionally, we'll examine the most common caching needs of the companies surveyed, their performance requirements, deployment environments, commercial and open-source software choices as well as their future direction.

Summary of Findings

This paper explores recent surveys of enterprise application architects and developers and their experiences using Ehcache to improve performance and latency with large data caches.

In summary, the data reflects the following results about Ehcache and the companies that use it:

STATISTICS	FACTS ABOUT EHCACHE USAGE
Company size	From smaller startups to multi-billion dollar corporations
Industries	A wide range, including the most demanding in terms of performance, latency and reliability
Cache types	General database caches, Hibernate, web-based data, RESTful services, replicated, distributed caches and other general-purpose needs
Data and cache size	A wide range of data sets, from less than one gigabyte (GB) of data to over one terabyte (TB)
Geographic reach	Ehcache users in over 250 countries; the survey represents respondents from over 40 countries
Licensing	Open source, commercial and a best-of-breed mix of products and technologies
Enterprise technology	Java SE applications, with common Java frameworks, servlet containers and full-blown Java EE deployments
Cache deployment	Both local and distributed caching; more than 70% of respondents would like to implement a distributed cache in the next 12 to 18 months
Repeat usage	Typically used with more than one application per user

Consistent with a 2009 Sun Microsystems report that showed 70% of its enterprise Java customers use Ehcache (Figure 1), these recent surveys show Ehcache is used in a large number of enterprise Java deployments.

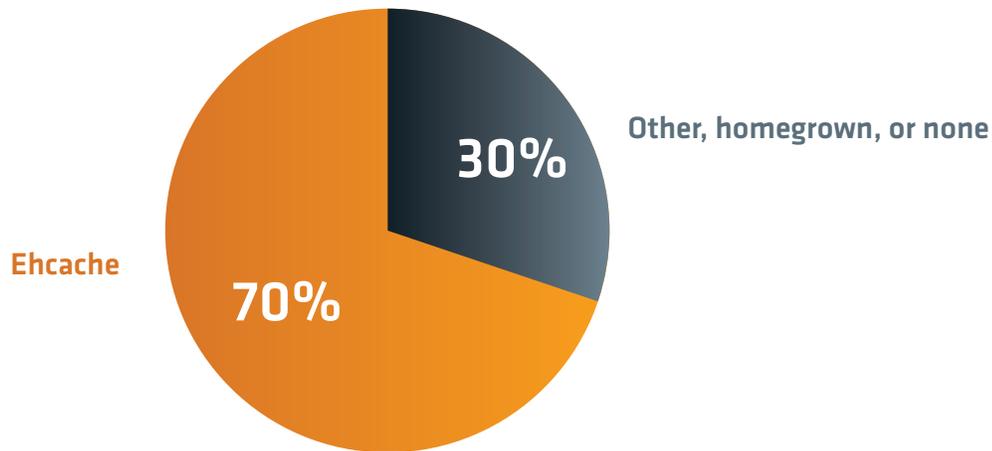


Figure 1: Caching in Enterprise Java Applications

Before we dive into the details of the survey data, let's examine some background information on Ehcache and enterprise data caching.

Introduction to Enterprise Data Caching

Most enterprise applications use data stored in a central resource, such as a database, web-service, or other type of external server. Accessing this external data can become a bottleneck to application performance. As a rule, the closer data is to an application, the faster the application executes. Bringing data directly onto the machine where the application runs offers the best performance. This is achieved by implementing an application data cache.

A cache stores data closer to the application in a format that allows for faster access, increased application throughput and reduced overall latency. While application developers often start building simple caching functionality in-house, the de facto caching standard for enterprise Java is Ehcache. Ehcache has more than 500,000 enterprise deployments, including the majority of the Global 2000. It ships both as a standalone package and as the default caching solution of many popular applications, containers and frameworks including Atlassian, ColdFusion, Grails, Hibernate, Liferay, Salesforce and Spring, among others.

"For us, Ehcache has improved performance and simplified development."

- CIO, USA

BigMemory for Enterprise Ehcache

For large caches that don't otherwise fit easily within a single Java Virtual Machine (JVM), Terracotta, the company behind Ehcache, offers a commercial product called BigMemory. BigMemory snaps into Enterprise Ehcache to maximize physical server memory usage and reduce latencies by providing an in-process, off-heap cache that's not subject to JVM garbage collection (GC). Measurements show that BigMemory provides fast, local access to large amounts of data, without GC pauses and without exhaustive tuning efforts.

BigMemory for Enterprise Ehcache supports both local and distributed off-heap caching. The result is a savings in time and effort otherwise spent designing and coding around JVM GC issues.

For more details, read the BigMemory whitepaper at terracotta.org/resources/whitepapers/bigmemory-whitepaper.

"Our servers have plenty of memory, yet the JVM cannot use it all due to GC-related heap limitations. BigMemory can help to improve this."

-Software Developer, China

Common Customer Deployments

Based on the recent surveys of existing Ehcache users, developers and architects consistently choose Ehcache to enhance their enterprise applications. In fact, the percentage of developers and architects who responded was nearly even at 40% and 38% respectively. The remaining respondents identified themselves as development managers and CIO/CTOs.

Let's take a more detailed look at how they are using Ehcache in their industries, applications and deployments.

Deployed Ehcache Versions

The surveys show that most of the existing Ehcache deployments are on the latest versions of software (Figure 2). This can be interpreted that Ehcache users remain active with Ehcache and choose to keep up with the latest features and improvements.

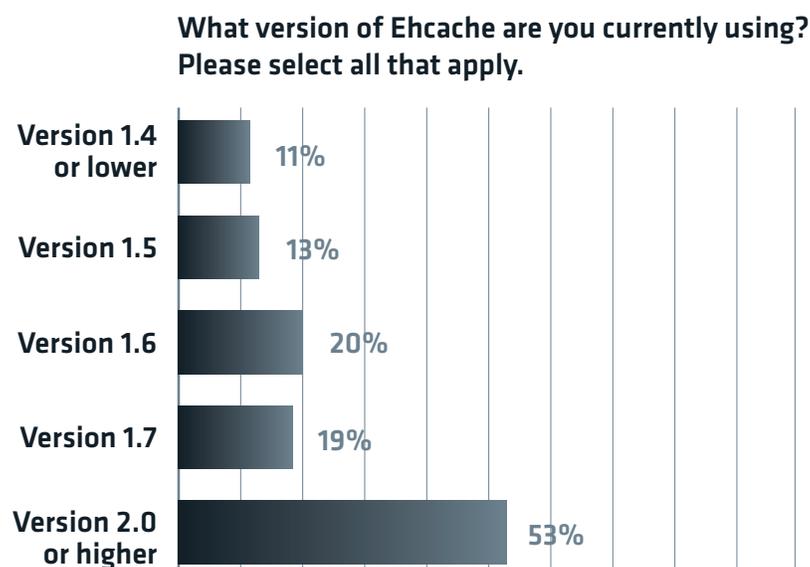


Figure 2: Ehcache Version Adoption

Types of Data Cached

As expected, Ehcache is used predominantly in database applications to bring critical data closer to the application logic. Hibernate and other database caching represent the most common use cases. However, a large and growing percentage use Ehcache with systems other than a database. For instance, users also deploy Ehcache to cache their web/servlet data, web-service/RESTful data and for other general purpose caching needs.

You should be able to fit Ehcache into many parts of your application, regardless of the types of data being cached.

Types of Enterprise Applications

Taking a deeper look at the survey data, we find that Ehcache is a popular choice among those building mission-critical and, in some cases, safety-critical applications. The surveys show that Ehcache has an especially high deployment rate within applications in the areas of telecommunications, banking, financial services and business services. It's interesting to note that these applications have strict performance, latency and reliability requirements.

"Ehcache has resulted in improved application performance, which is the most important factor in our application."

-Software Developer, Argentina

Universal Customer Deployment Base

Although many Ehcache deployments are within the United States, there's strong adoption among companies around the world. Companies in over 250 countries currently deploy Ehcache within their enterprise applications. Of these, Ehcache has an especially high deployment rate within the United States, Germany, the United Kingdom, India, Canada and China. Users from over 40 countries responded to the surveys.

Based on the survey data, companies of all sizes, from startups to multi-billion dollar industry leaders, choose Ehcache for their enterprise data caching needs (Figure 3). Over a quarter of the companies that responded to the Ehcache surveys have revenue of at least \$1 billion, with a good percentage exceeding \$5 billion in revenue. Companies at that level often have more at risk, with stricter service-level agreements.

What is your company's annual revenue?

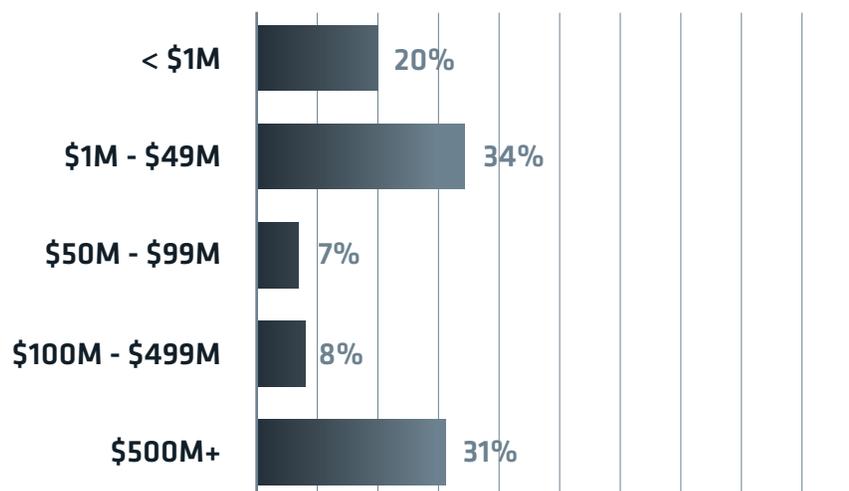


Figure 3: Annual Company Revenue of Surveyed Ehcache Users

Enterprise Software Solutions: Best-of-Breed

Many of the survey respondents choose to deploy a mix of open source and commercial software, suggesting a decision to use best-of-breed software over zero-cost. In other words, the overall value and quality of the software—which includes performance, robustness and product support—is just as important as its price tag. For those who are running open source software, they generally choose from a limited set of proven technologies from trusted sources.

If you didn't acquire Ehcache directly, which framework or product was it bundled with? Please select all that apply.

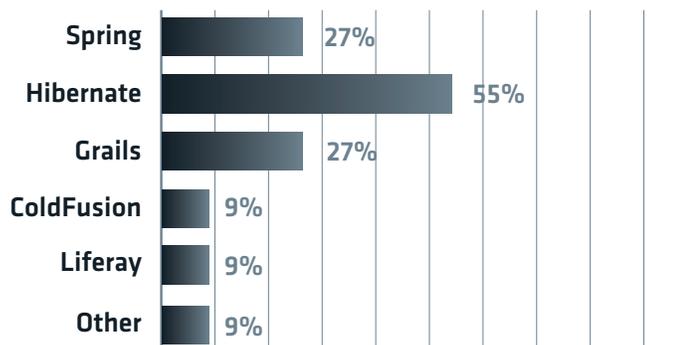


Figure 4: Bundling

Which of the following Java containers do you use? Please select all that apply.

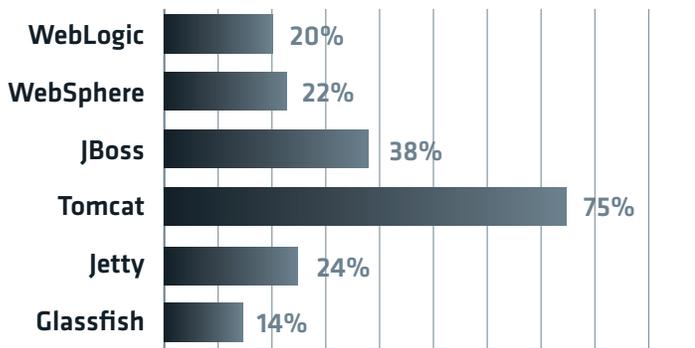


Figure 5: Java Container Adoption

Ehcache is bundled with many of these open source technologies. As the data indicates, many of the respondents acquired Ehcache through other open source software, primarily Spring, Hibernate and Grails (Figure 4). Ehcache is also offered under a commercial license and, like the open source option, works with all of the popular commercial Java containers.

Let's take a closer look at what the data shows, and how Ehcache fits into enterprise users' choice of products and technology.

Open Source in the Enterprise

The survey results show an overwhelming majority of respondents use Apache Tomcat as their application server. This indicates that a Java Servlet-only deployment continues to be a popular enterprise Java architecture strategy. However, when a more complete Java EE stack is needed, other leading open source solutions include JBoss and Oracle's Glassfish Server (Figure 5).

Regardless of your license choice—open source, commercial or a best-of-breed mix—Ehcache integrates with a wide range of technology choices. As a result, you won't need to make compromises in your architecture or deployment philosophy.

Technical Specs: Environment, Data Sizes and Caches

The surveys gathered information on the production environments of Ehcache users, including the data sizes within their applications, the distribution of the application logic and information about the servers themselves. Most surveyed users deploy production servers with around 16 GB of physical RAM, but a large and growing percentage deploys servers with more than 64 GB of RAM (Figure 6).

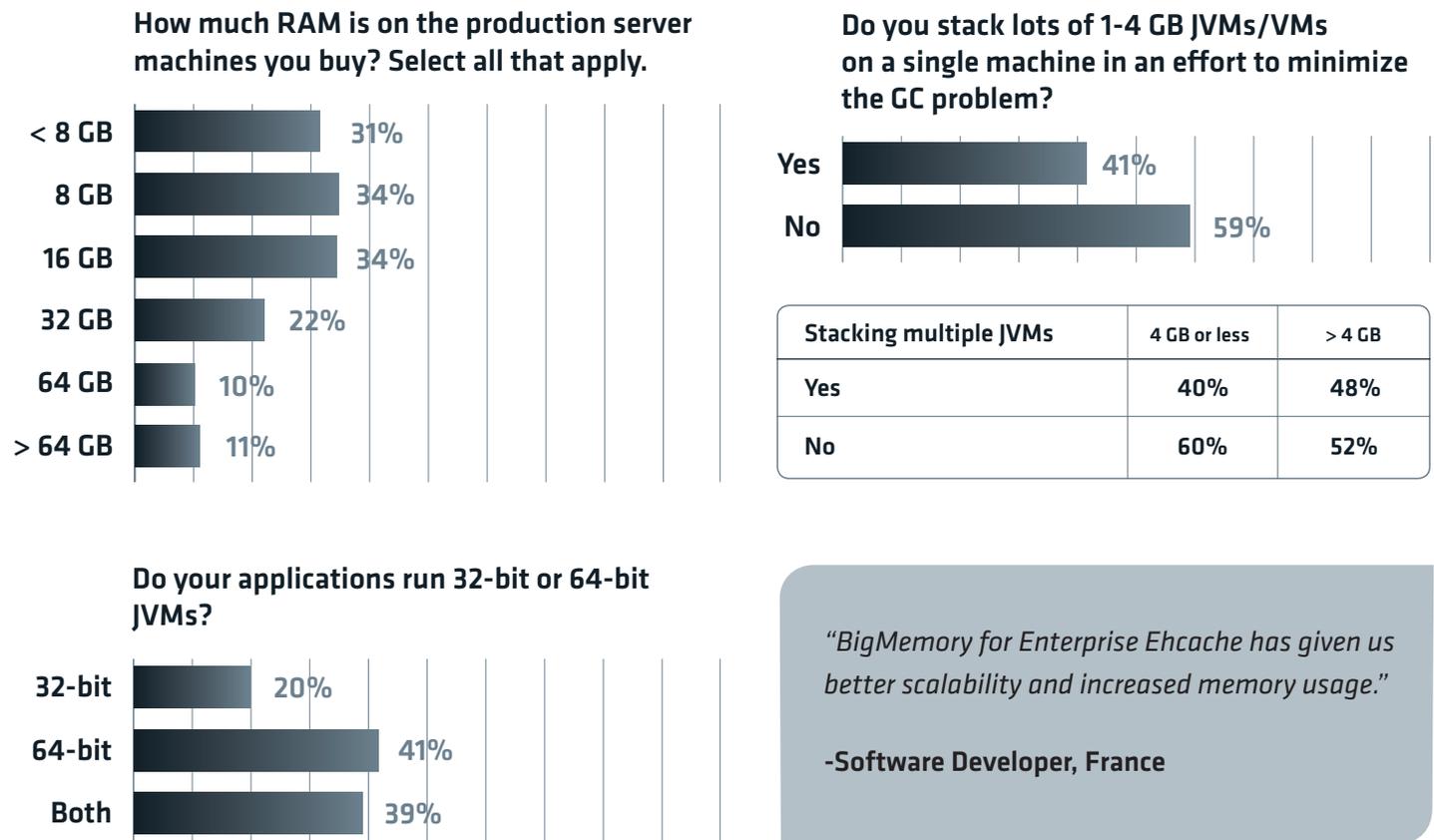


Figure 6: Deployment Environment

Users clearly have a desire to get the most out of their hardware investment. As a result, the data tells us that almost half run multiple JVMs with relatively small heap sizes on one server. This is likely due to garbage collection issues with large JVM heaps. Let's take a look at the data and cache size results in more detail.

Ehcache Application Deployments

In terms of repeat usage, most use Ehcache with more than one enterprise application and, in many cases, this includes as many as five or more applications (Figure 7).

The survey data shows that most respondents use Ehcache with up to five JVMs within a single enterprise application deployment. However, a large percentage uses it with 20 or more JVMs. Users run so many JVMs in order to distribute cached data across data centers, take advantage of hardware virtualization and avoid GC-related issues. We will explore these in detail in the next section on distributed caching.

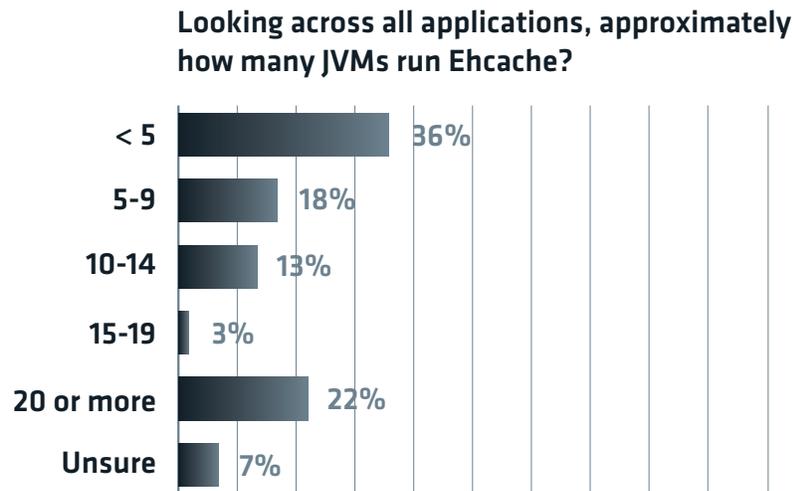


Figure 7: Number of JVMs Running Ehcache

Data Set and Cache Sizes

In terms of data set sizes commonly used with Ehcache, there is a relatively equal distribution between small and large data set sizes (Figure 8).

Overall, most data sets fall within the 1-20 GB range, with some as large as 1 TB or more. As far as actual Ehcache sizes, most fall within the 1-6 GB range, again with some as large as 1 TB or more. The relatively small cache sizes of the 1-6 GB range may be due to JVM heap-size constraints caused by garbage collection issues. Let's take a closer look at these issues now.

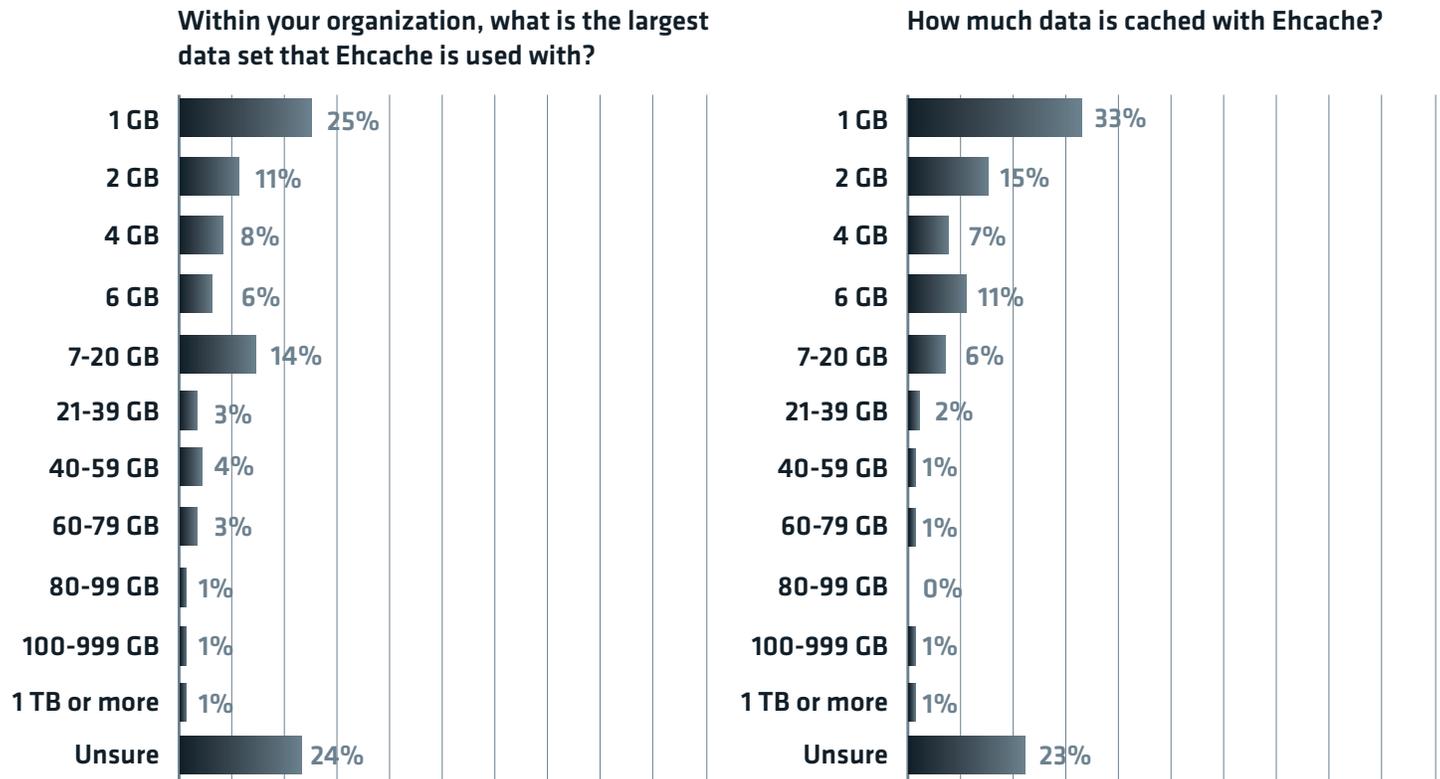


Figure 8: Data Set and Cache Size

Distributed Caching – No Heap Size Limitations

Ehcache and the Terracotta Server Array support distributed caching where data is purposely distributed across separate caches on different JVM instances and server nodes. The survey data indicates that a growing percentage of enterprise applications use this capability today and the majority of the respondents plan to use Ehcache as part of an emerging distributed cache design in the next 12 to 18 months.

Developers and architects use Enterprise Ehcache and BigMemory to balance how they scale their deployments. As the data indicates, they are using larger servers, more servers or a combination of both.

Enterprise Ehcache offers a balance in terms of how to scale and the freedom to make a choice that's right for each of your applications.

While there certainly are good reasons to distribute application data across multiple applications' servers, across an enterprise and even across geographically separated data centers, enterprise developers need to distribute data across multiple JVMs due to heap size limitations. For instance, data caches that reside within the JVM heap that exceed 4 GB in size often result in large GC pause times that adversely affect application performance and latency.

BigMemory for Enterprise Ehcache solves this problem by keeping large data caches within the memory space of a single JVM, but out of the JVM's heap. As a result, you can keep the JVM heap relatively small and eliminate these GC issues.

“GC creates a lot of problems in our applications. With BigMemory, we hope to reduce the time and the complexity of GC configuration, and avoid unpredictable pauses.”

-Enterprise Architect, Germany

Conclusion

As both an architect and developer for multiple enterprise applications, I've seen many proprietary, custom cache approaches implemented and maintained. Each one was different, required a lot of ongoing development and tuning, and often led to tradeoffs between memory usage and performance. Unfortunately, the demands to add new application features always outweighed the needs to improve the cache, and performance and latency often suffered.

A general purpose, off-the-shelf, cache software package would have saved my development teams a lot of time and effort. It's good to know that Terracotta's Ehcache offers just such a solution, and that other enterprise developers around the world are benefiting from it. Before you roll your own, or spend any further time tuning your existing solution, take a look at how Ehache can improve your application, and save you time and money in the process.

Summary of Demographics

Although the survey demographics have been mentioned throughout the paper, let's summarize them here. The majority of respondents identify themselves as developers and architects (Figure 9).

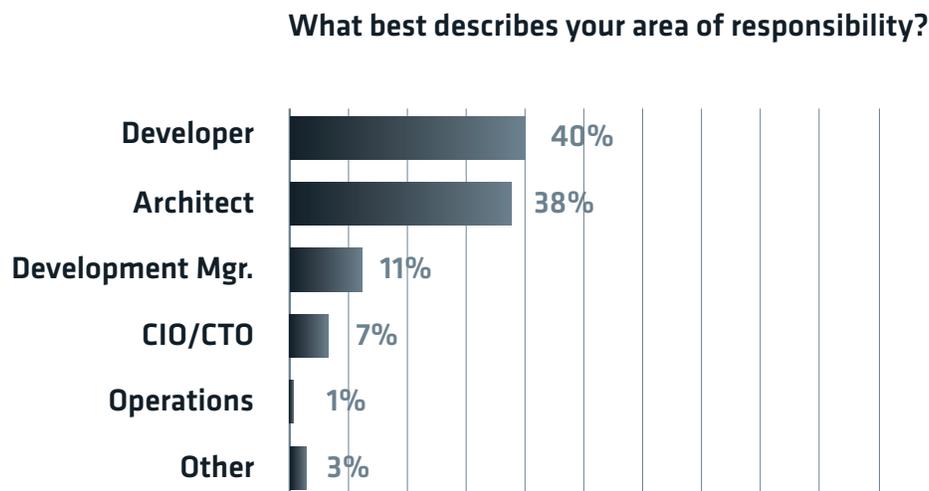


Figure 9: Respondents' Roles

Companies in over 250 countries worldwide deploy Ehcache within their applications. Figure 10 lists a sample of the 40 countries represented by the survey respondents.

Argentina	India
Australia	Israel
Belgium	Poland
Canada	Singapore
China	Sweden
France	United Kingdom
Germany	United States

Figure 10: Sample of Respondents' Countries

Figure 11 lists the industries represented by the survey respondents.

Telecommunications Services	Electronics
Banking	Media
Business Services	Consumer Products Manufacturers
Financial Services	Energy & Utilities
Computer Services	Industrial Control Products Manufacture
Education	Online Gaming
Government	Pharmaceuticals
Automotive & Transport	Real Estate
Healthcare	Retail
Insurance	Security Products & Services
Aerospace & Defense	Telecommunications Equipment
Consumer Services	Transportation Services

Figure 11: Respondents' Industries

About Terracotta

Terracotta's software products provide snap-in performance and scale for enterprise applications. Our flagship product, Enterprise Ehcache, extends the capabilities of Ehcache, the de facto caching standard for enterprise Java and the default cache for Hibernate, Spring, Grails and other leading frameworks.

With more than 500,000 enterprise deployments, including the majority of the Fortune 2000, Terracotta is behind some of the most widely used software for application scalability, availability and performance. For more information, see www.terracotta.org.

Terracotta, Inc.
575 Florida St. Suite 100
San Francisco, CA 94110
USA

Product, Support, Training and Sales Information

sales@terracottatech.com

USA Toll Free

+1-888-30-TERRA

International

+1 415 738-4000

Terracotta China

china@terracottatech.com

+1 415 738-4088