TERRACOTTA

Terracotta Ehcache

Improve Application Performance and Scalability with Terracotta Ehcache

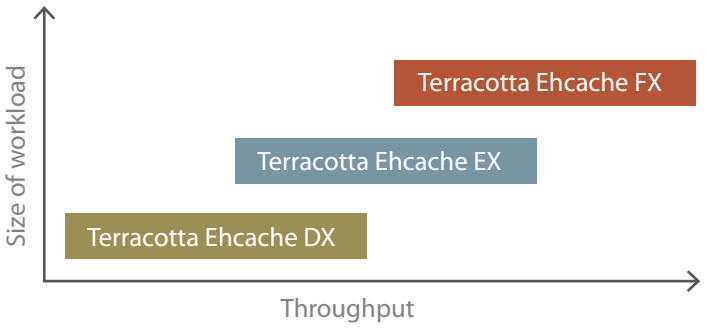
In modern online applications, performance is critical. A study performed by Amazon states that every 100ms of latency costs them 1% sales, which in Amazon dollars translates into more than $50M per year. Google similarly found that just 1/2 of asecond of delay caused more than a 20% drop in traffic [Linden].

Yet performance is only half the story. Application workloads are rapidly increasing. In June 2009 the number of Internet users grew to a staggering 1.7B [InternetWorldStats].

Modern web technologies like AJAX and Comet tax applications more heavily than their traditional brethren. Also, new platforms like the iPhone, which saw a whopping 626% increase in adoption in 2009 [IBTimes], add new access patterns to the mix.

So, how can an application handle this increasing workload and keep performance acceptable? Many solutions such as expensive clustered application servers and highend databases are available. Each has advantages and disadvantages. Yet the simplest and most cost effective strategy is to add caching where caching is needed most - at the application layer.

Terracotta's Ehcache Product Line



In this white paper you will see how to boost performance with Terracotta's Ehcache caching products, identify how to select which Ehcache product is right for your application, and see in performance comparison based on Spring's Pet Clinic application how Terracotta stacks up against the database, a leading in-memory data grid (IMDG), and memcached.

In short, see why over 100,000 deployments already rely on Terracotta's Ehcache line of products for a simple cost-effective approach to boosting performance, scale, and reliability for Java applications.

About Terracotta Ehcache Products

Terracotta Ehcache caching products allow your application to utilize the full power of the Terracotta platform by providing a simple plugin object cache using the industry standard Ehcache interface or Ehcache's plug-in support for the the JSR-107 interface.

Terracotta Ehcache products also may be used as a Hibernate second level cache.

When scaling an application to meet increased demand, the Terracotta platform outperforms other products because of its advanced clustering technology.

Sophisticated algorithms replicate data asynchronously, preventing bottlenecks from arising, while preserving causal ordering, which provides data coherence. This technique is used by the JVM itself on multi-core hardware to provides both correctness and high data throughput.

Selecting the appropriate Terracotta Ehcache Product

Selecting which Terracotta Ehcache product to use begins with an understanding of the working dataset for your application, and the subset of this data that is accessed most frequently and is thus a good caching opportunity. This is sometimes called a "hot set." For example, if 25K users are logged in to your web application, each accessing 1KB of data from the database, then the hot set is the product of the number of users and the data per user, 25K*1KB, or 25MB.

Selecting the appropriate product also requires that you understand the availability requirements of your application. If your application requires continuous business operations in the face of failures, it will require more than one JVM (often referred to as a cluster or application cluster).

If your application's working hot set fits in memory, choose Terracotta Ehcache DX. Sharing of the data-set is not required, and your application's throughput requirements can be met by one JVM.

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Terracotta's Ehcache Product Line

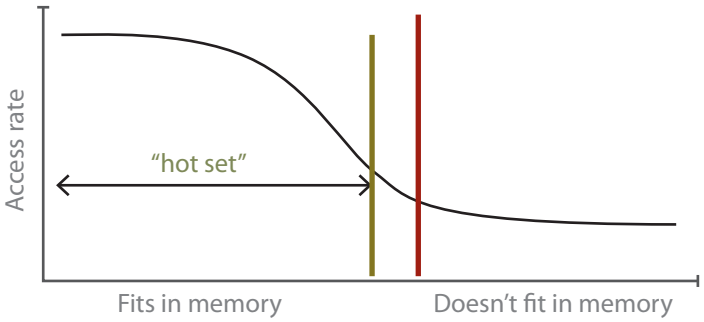

Figure 1. The working data-set fits in memory.

For standard workloads, choose Terracotta Ehcache EX. Your application's data hot set is unlikely to fit in memory, or it may be advantageous to share the data set across more than one JVM. Your application must continue to run in the face of failures and/or has throughput requirements that cannot be met by a single JVM.

For demanding or elastic workloads, choose Terracotta Ehcache FX. Your application's hot set does not fit in memory, and it is a requirement to share data across many JVMs. Your application demands high performance, high availability and high throughput. Also, Terracotta Ehcache FX is ideally suited for the elastic requirements of virtualized environments.

Cacheable Data Set

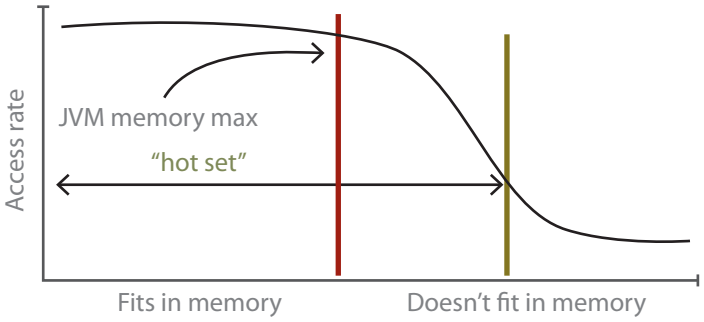

Figure 2. The working dataset does not fit in memory.

Comparing Terracotta Ehcache Performance

Understanding performance behavior specific to your application can be a challenging task. Every application workload is unique. To provide reliable metrics for comparison, Terracotta has benchmarked the Spring PetClinic reference application against competitive solutions.

The following competitive solutions were measured:

Terracotta Ehcache: Configured as a Hibernate second-level cache. The Terracotta Server Array was configured for one instance when using Terracotta Ehcache EX and four instances when Terracotta Ehcache FX.

Memcached: Open source caching product configured as a Hibernate second level cache.

Commercial IMDG : A leading commercial in-memory-data-grid (IMDG) product configured as a Hibernate second level cache.

MySQL Database: Default configuration of the application with no caching configured.

For each configuration two application workload tests were performed which simulate common web application behavior:

100-0: This test executes read-only operations. No write operations are made to objects or database entities. This test is referred to as the 100-0 test, indicating 100% read, 0% write.

90-10: This test simulates mostly read with infrequent write operations. This test is referred to as the 90-10 test, indicating 90% read, 10% write.

Each of the 100-0 and 90-10 tests were then executed with varying data "hot set" sizes of 25k entities, 50k entities, 150k entities, and 250k entities.

Note that you should use these results as a guideline only. Consider contacting Terracotta for assistance if you wish to perform your own comparisons. To provide meaningful results, the non-Terracotta products used in this comparison were tuned by independent third party experts to ensure optimal configuration for these comparisons

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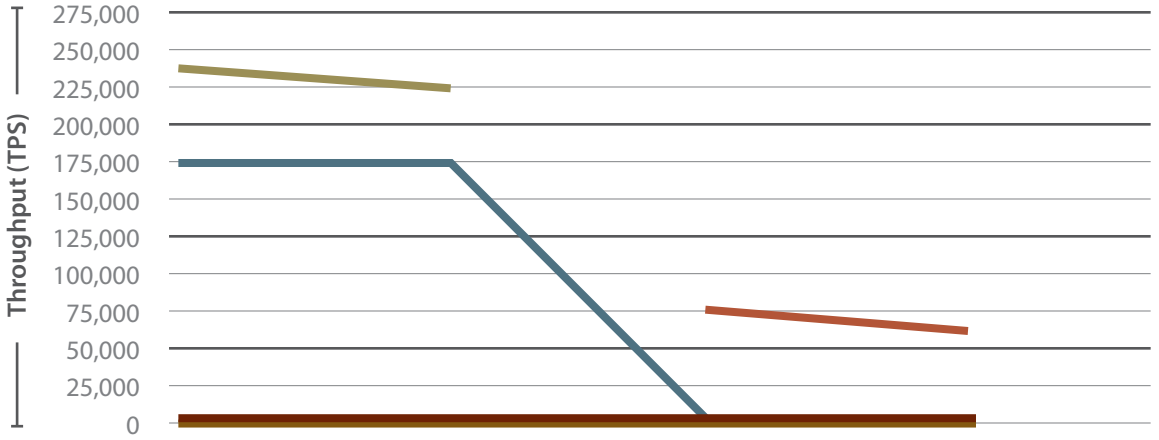
100-0 Read-only Test

In the graphs below, the test results for the 100-0 test show that the Terracotta Ehcache product provides significant boosts in throughput vs. competing solutions.



	25K	50K	150K	250K
Terracotta Ehache EX	239,101	227,797		
Terracotta Ehcache FX			72,420	66,022
Leading IMDG	177,129	174,879	5,702	5,210
Memcached	4,892	4,883	5,003	4,901
Database	1,360	1,122	1,122	1,013

Data-set Size

As expected, the pure database backed approach provides the worst performance, followed by memcached and the IMDG. Terracotta's caching based approach brings data closer to the application, where it is accessed at in-memory speeds, rather than network speeds which accounts for the difference.

Note that for small data sets the IMDG also has some features to bring data closer to the application, which accounts for its high performance with small data sets.

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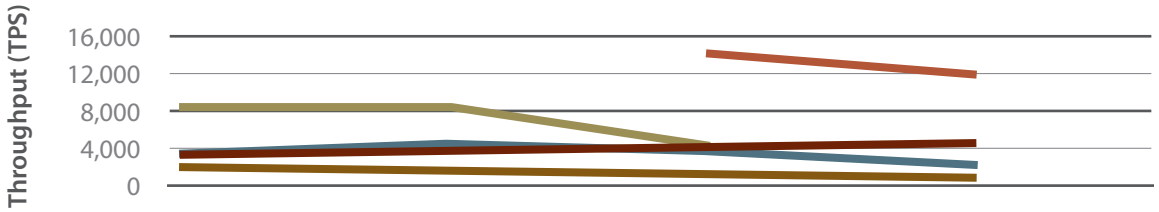
90-10 Mostly Read Test

In this test we see that the database again provides the worst results, followed next by memcached and the IMDG, all of which are no match for the optimized locality of reference and high performance clustering Terracotta Ehcache EX and FX provide.

Observe that Terracotta Ehcache EX provides the best results for small datasets, but as the working data-set size increases, Terracotta Ehcache EX provides diminishing advantage over the alternatives. By moving to the Terracotta Ehcache FX product, the performance advantage for larger dataset sizes of 150k and 250k elements is not only sustained, but enhanced, relative to alternatives.

Conclusions



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Data-set Size

This white paper has discussed how to select the proper Terracotta Ehache product to meet your needs, as well as performance testing results using a third party application, Spring PetClinic from SpringSource.

Generally speaking, when your data "hot set" fits in memory, look to Terracotta Ehcache DX for a high performance cache with enterprise support and time-saving monitoring and management features. In cases where the hot set is unlikely to fit in memory or if you need data coherence across many JVMs, try Terracotta EX, which distributes the cache using the Terracotta Server Array. In cases of extreme scale, or in virtualized environments where elasticity is important, the data partitioning in the Terracotta Server Array of Terracotta Ehcache FX will maximize your application's ability to meet mission critical scalability requirements.

In the tests discussed above, Terracotta Ehcache delivered the best performance results across a range of scenarios representative of common workloads. In both the Spring PetClinic 100-0 read-only and 90-10 read-mostly tests shown here, Terracotta Ehcache products demonstrated clear, consistent 2-10X throughput gains versus a popular in-memory data grid (IMDG), a popular relational database, and memcached. In read-only use cases, throughput gains versus the relational database and memcached were especially dramatic, being on the order of three orders of magnitude.

Terracotta Ehcache products drive notably higher throughput compared to alternative products, which is why they're on the short list for distributed cache implementations in enterprises throughout the world today.

To learn more about high performance, scalable distributed caches that maintain data consistency, visit http://www.terracotta.org/distributed-cache today.

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Contact us to learn more about Terracotta products, services, and support. Please visit us at www.terracottatech.com, e-mail us at info@terracottatech.com or contact one of our sales professionals at (415) 738-4000.

Configuration Specifications

Machine	Client-JVMs: - Total of 8 - 1.75G Heap. - Hardware: 4 x Quad-Core AMD Opteron Processor 2350; 4 GB Terracotta-Server JVM: - Total of 2 in Network-Active-Passive (high HA) setup. - 6G Heap - Hardware: 4 x 2 GHz Opteron 2350; 8 GB; 1 x 73 GB 15K HD
Network Interface	Switched Gigabit Ethernet
Database	MySQL 5.1 Hardware: 4x2 GHz Opteron 2350, 8GB, 1x73GB 15K HD
Application	Spring PetClinic

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