Transforming Java applications for business real time and the Cloud

Creating opportunities for business innovation using Azul Zing®
# Table of Contents

- Introduction  
  - Java challenges for modern applications  
- Zing: Java for business real time  
- Reference Architecture  
- Use cases  
- Choosing a Java Virtual Machine  
- Business value  
- Summary
Line of business technology executives are faced with incredible challenges and opportunities. With the ever-rising bar of business and user expectations, pressure to innovate and deliver has never been greater.

This emerging Real Time Business Imperative means businesses must now leverage new technologies and high volumes of data to deliver insight, capability and value faster than ever, with near zero tolerance for inconsistent delivery and uneven performance.

Java is a key technology for today’s Real Time enterprises across a broad range of industries such as capital markets, communications, gaming, online advertising, omnichannel commerce and insurance.

And while Java has been a tried and true platform for delivering business critical applications, it is a general purpose environment, dating back from over a decade ago. Today’s Java-based solutions are a product of this legacy, often proving to be brittle, inconsistent and inefficient in meeting these new demands—constraining growth, opportunities and profitability. Businesses are left over-investing in infrastructure while also supporting, tuning and managing production apps and avoiding moving apps to the Cloud. The net result is that they are leaving new opportunities on the table.
What if enterprises had a new, innovative Java that was designed to support the Real Time Business?

Java that is standards-compliant, commercially proven and purpose-built for the demands of today’s business-critical real time applications. Java that is robust, consistent, scalable, agile and self-tuning.

Java that enables companies to focus on delivering new business value and innovation at scale, rather than continually re-tuning Java apps and the network environment. Java that is proven in real-world deployments. And an open source Java option for servers, clients and embedded systems with long lifespan, affordable support.
The major challenges Java faces for real time business include:

**Practical memory limits in a world of cheap memory.**

The Java programming language utilizes a managed runtime (the Java Virtual Machine, or JVM) to improve developer productivity and provide cross-platform portability. Because different operating systems and hardware platforms vary in the ways that they manage memory, the JVM performs this function for the developer, allocating memory as objects are created and freeing it when they are no longer used. This process of freeing unused memory is called ‘garbage collection’ (GC), and is performed by the JVM on the memory heap during application execution.

When memory fills, most JVMs pause application processing to perform garbage collection. The length of this pause is directly proportional to the size of the memory heap, so IT organizations tend to limit the JVM to a 3-4 GB heap for each instance to keep garbage collection pause times low. This is the practical limit on the amount of memory available to a Java instance.

Application demands for memory have been growing exponentially, and memory on a server is cheap. Unfortunately, Java was designed when memory was expensive and never anticipated garbage collection pauses that are minutes long on large heaps.
Scale out in a scale up world.

Because of this memory limitation, Java applications have been limited to scaling out (via a large number of small instances) instead of up (via a very small number of large instances). Scaling out has had a significant cost. Businesses have been saddled with poor resource utilization on servers. A server that routinely ships with 250GB of memory today may eventually contain dozens of 3-4 GB Java instances. Since each instance is unlikely to be using all of its memory at once and they can’t ‘borrow’ from one another, much of the capacity of the server goes to waste.

Cloud incompatibility.

The ideal Cloud deployment, whether public or private, allows an application to scale to meet the needs of the business in real time. However, current Java Virtual Machines can experience significant performance degradation and throughput fluctuations when deployed on Cloud infrastructure. The memory size limitation on each instance means that they can’t grow and shrink as needed—new instances must be launched and torn down. Basically, existing JVMs weren’t designed to leverage the advantages of virtualization and the Cloud. This prevents companies from pursuing potentially lucrative opportunities using Java applications.
Inconsistent response times and latency outliers.

Consistency has been Java’s Achilles heel. Java can be very fast, often as good or better than C or C++ in real-world applications. Modern optimizing JIT compilers generate great code. But, enterprises have seen what happens in the real world. The application runs fine—for a while. Then it slows down, stops, stalls, freezes or crashes.

Many systems have an average response time that’s fine, but a worst case that is far too high.

These worst case response times can cause a huge negative impact on business. Studies have shown that customers will leave a website after just a couple of seconds of delay and many will not return. In online advertising or high frequency stock trading, a millisecond can mean the difference between a successful bid and a missed revenue opportunity.

Companies spend days, weeks, even months trying to tune away inconsistencies, but each time the application or its load changes, the whole process starts again.

Needs to warm up

The JVM has a built-in optimizer that compiles frequently used code. Unfortunately, it takes time for the system to learn which code is popular so it can be compiled. The result is that Java-based systems start up slow, and slow down again any time load profiles change.

Big Data and NoSQL

Many Big Data and NoSQL technologies are written in Java. They also rely on in-memory data for processing and fast query response times. Unfortunately, heavy user and transaction loads fill up memory quickly, leading to frequent garbage collection pauses that cause node stalls, slow response times, and even cluster thrashing and crashes.
Zing eliminates disruptions, glitches and pauses caused by the underlying Java infrastructure and allows applications to start up fast and stay fast. Now enterprises can meet all their service delivery standards and provide a better customer experience to drive more revenue.

Zing also unlocks companies’ ability to innovate. By eliminating tuning and making it easy for developers to create data- and transaction-intensive applications that scale seamlessly, businesses can get new functionality into production faster. And, the best developers can focus on creating new capabilities instead of tuning and re-tuning production applications. With better operational and capital efficiency, enterprises can serve more customers on existing hardware and software and have additional resources available for innovation.
The New Performance Standard.

Zing is the new performance standard for Java. It delivers great performance, all the time, with no excuses. Java’s optimizing compilers already generate great code; with Zing, that speed is now available without glitches, pauses or jitter, from the first transaction, even when demand spikes. Zing improves the performance of existing applications (even older applications reaching end of life) without coding changes. For the first time businesses can leverage the efficiencies of Java for applications where only C/C++ could be used before and gain competitive advantage from aggressive in-memory computing initiatives.

Out of the box Zing reduces peak response times to just a few milliseconds. Companies immediately see better performance and responsiveness for Web-based (user interactive) applications. Zing reduces max outliers across a wide range—from 10s of microseconds in highly tuned trading applications to hundreds of milliseconds in complex Web apps.

Zing ReadyNow!™ technology slashes warm up time, allowing applications to start up fast and stay fast. It gives developers the ability to specify which code gets compiled, and devops teams can save compiler optimizations across runs to eliminate re-learning on similar loads.
Unlocking Innovation

Real-time business has an overwhelming need to deliver competitive advantage and adjust to the changing marketplace fast. Zing helps development and IT teams deliver more functionality faster. They spend far less time chasing production performance issues with existing applications, freeing up time to work on new initiatives. Zing also allows them to take advantage of the rich array of standard tools and libraries available without creating performance headaches down the road.

Many new business opportunities, including Cloud, Big Data, SaaS and others, just don’t work well with traditional Java infrastructures. Traditional JVMs’ lack of scalability and memory limitations prevent companies from launching revenue- and competitive advantage-producing services. Zing makes far better use of today’s large-memory multicore servers so companies can host more users on existing hardware while also delivering nearly unlimited scalability and supporting very large in-memory data sets. Zing unlocks an enterprise’s ability to innovate.

The need for speed never ends, and Zing helps companies get new business models, strategies and product/service offerings to market faster with less testing and tuning. It also sets the stage for actionable, “real-time” Big Data and in-memory computing applications that will allow companies to react to market changes in seconds or minutes and beat competitors.
Other Java Options

Azul Zulu and Zulu Enterprise provide companies with a multiplatform open source Java option with long lifespan support. For applications running on older versions of Java or where frequent Java upgrades don’t fit with business priorities, Zulu is an excellent alternative. Zulu jumpstarts application development and deployment for firms running their businesses on public clouds, including Microsoft Azure and Amazon AWS.

Zulu Embedded provides scalable, customizable builds of Zulu tailored to the needs of your Embedded System or IoT project.

Capital Efficiency

Zing drives capital efficiency. Today’s commodity servers can support massive amounts of memory and multiple cores. This should equate to more speed and better scalability. Unfortunately, most JVMs require enterprises to chop up applications into small instances to avoid performance issues, making data models more complex, and operations an ongoing headache. Zing is the only JVM that breaks the link between memory size and performance so companies can take advantage of all available memory and CPUs on existing servers. It also delivers 2-3X more sustained throughput on existing infrastructure. Zing allows firms to scale up rather than out, and put far more users and transactions on the same server, without crashing.

Efficiency isn’t just about how well companies can utilize hardware and software in the datacenter. Developers are a key resource. With a worldwide war for the best talent, it’s hard to hire top developers to fix current performance issues. They’d much rather work with the best tools on leading edge challenges that will make a difference for the business—and companies would rather they did that, too. Zing eliminates the ongoing tuning and performance issues that have distracted developers, kept them from building new functionality and tempted them to post their resumes on jobs boards.
Reference Architecture

- **Application**: Java, Clojure, Scala or other JVM-based language
- **Container**: JBoss, Weblogic, WebSphere, Jetty, JOnAS
- **Java Runtime**: Azul Zing or Zulu
- **Operating System And/or Hypervisor**: Linux, VMware, Xen, Private cloud, AWS, Azure, Rackspace
Use Cases SaaS

**Vocalabs**

“We With Zing our reporting engine shows its best side. It’s not hobbled by the JVM anymore.”

—Daniel Taylor, VP Operations, Vocalabs

**Challenge:** The reporting application’s response time was sluggish, with occasional multi-minute delays. This impacted the customer experience and prevented Vocalabs from including all the latest data in reports.

**Solution:** Zing provides consistent response times around 6 msec and delivers ~7x headroom for growth.

**SuccessFactors**

“We With Zing we can scale up with software.”

—CTO, SuccessFactors

**Challenge:** Scaling the on-demand performance management suite to handle SuccessFactors’ rapid growth.

**Solution:** Zing allows SuccessFactors to launch large new customers without performance worries.
Use Cases Financial Services

Market Maker

**Challenge:** Garbage collection pauses of up to 3 seconds delayed execution and resubmission of stock trading orders.

**Solution:** Zing eliminated pauses and order delays. The company only needed one day to set up and tune Zing.

Financial Pricing Engine

**Challenge:** The system for transmitting client-specific tradable prices was experiencing long garbage collection pauses. Within the 14 msec SLA for the system, the existing JVM could only deliver 29,000 pricing updates.

**Solution:** Zing eliminated pauses and increased the number of messages delivered under the SLA to 55,000.

Top 20 Global Bank

**Challenge:** The bank’s new risk and position monitoring system needed to go live quickly, and costly re-tuning each time more data was added was unacceptable.

**Solution:** Zing required very little tuning up-front and is elastic to accommodate future data growth without further tuning.
Use Cases User Interactive

**Challenge:** The company was migrating from Microsoft FAST to Apache Solr but experienced long application pauses during Beta testing.

**Solution:** Zing provides a better user experience with faster page rendering and search results.

“Without Zing we would not have been able to deploy Apache Solr for our production system. Our customers could have experienced long pauses when searching for critical documents.”

—Mou Nandi, Search Engineer and Architect, NetDocuments

**Challenge:** The company was facing explosive growth and having difficulty scaling to serve more concurrent players without long system pauses.

**Solution:** Zing creates a strong foundation for continued business growth and allows Smart Bomb to serve far more users with fewer nodes. With Zing, the company’s online gaming provides a rich, engaging social experience that encourages users to stay and return.

“Our 6–12 year old user base loves the social aspects of our online games. With Zing, more players can interact without the risk of dropped players”

—Kris Johnson, Chief Operating Officer, Smart Bomb Interactive
Zing

High Performance JVM

- Fully Java SE compliant
- Pauseless operation
- Large heap sizes (up to 1 TB)
- 2-3X more sustained throughput
- Minimal tuning requirements
- Elastic resource utilization based on real-time demand
- ReadyNow! technology slashes warm up time
- Zing Vision zero-overhead diagnostic tool
- Low latency financial applications

Choose Zing for:

- SaaS deployments
- Cloud-based solutions
- In-memory and Big Data analytics
- Cassandra, DataStax and other NoSQL databases
- Web scale applications
- Real-time advertising networks
- Online and social gaming
- Omnichannel commerce platforms
- Complex event processing
- Real-time messaging
- Enterprise search
Zulu

Free and Open Source JVM

• Fully Java SE compliant
• Leverages the latest advances in OpenJDK™
• Free and open source
• Replaces current JVM without coding changes
• More deployment flexibility—server, client, Cloud or virtualized OS
• Control over upgrade timing
• Minimum 10 years’ support lifespan for major releases

Choose Zulu for:

• Economical, world-class enterprise support
• Supports Windows Client, Windows Server, multiple Linux distributions and Mac OS X
• Apps whose Java version is no longer supported by other vendors or where support is expensive
• Windows Azure and Amazon AWS deployments
• Systems with stable growth rates
• Extending the lifespan of older applications
• World-class JVM enterprise support
Zulu Embedded

Embedded Systems and IoT

• Scalable and customizable
• Based on Azul Zulu builds of OpenJDK™
• Free and open source
• Premium technical support included
• Available for a wide variety of operating systems, hardware platforms, processors and Java configurations
• Flexible pricing models
• Easy redistribution

Choose Zulu Embedded for:

• Home & Building Automation
• Healthcare
• Manufacturing Automation
• Networking Equipment
• Smart Grid
• Automotive
• Online Storage/NAS
• Consumer Electronics and Home Gateways
• Retail Point of Sale Systems
Eliminate most JVM tuning
- Days, even weeks of lost developer hours each time the application is modified

Capture lost revenue opportunities
- Retail/eCommerce: increase shopping cart success rates 3% or more
- Insurance: increase success rates for online quoting
- Real time advertising: more successful bids for increased click-through and revenue
- HFT, algo trading, Forex: never miss a trade due to platform stalls
- Eliminate garbage collection issues

Increase infrastructure efficiency
- Handle 2-3X more users or transactions on existing hardware
- Get 40% more utilization from your current servers
- Delay or cancel new hardware purchases

Pursue new opportunities
- Launch Cloud or SaaS services not practical with other JVM technologies
- Deploy new algos faster to create competitive advantage
- Add memory-intensive features that increase conversion rates and order size
- Manage risk of new initiatives better using more comprehensive real-time information
Count on Azul Systems to help you get the most out of your Java applications:

- Transform Java applications for business real time
- Open up new opportunities for innovation
- Expand the capabilities of analytics and Big Data
- Migrate applications to the Cloud without recoding
- Improve overall performance, consistency and reliability
About Azul Systems

Azul Systems, the industry’s only company exclusively focused on Java and the Java Virtual Machine (JVM), builds fully supported, standards-compliant Java runtime solutions that help enable the real time business. Azul is a member of the Executive Committee of the Java Community Process (JCP), the Eclipse Foundation and the Cloud Foundry Foundation. For additional information, visit:

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