



OpenJDK & IcedTea

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OpenJDK



OpenJDK

- Open-source implementation of Java Platform SE
 - Compiler and other development tools
 - JRE
 - Libraries + JavaDoc
- Packages are now available for many systems
 - RHEL 5
 - Fedora 9, 10, 11, Rawhide...
 - Ubuntu \geq 8.04
 - openSUSE
 - Debian
 - ...



History

- November 2006
 - HotSpot VM and compiler released under GPL
 - Not fully buildable JDK yet
- May 2007
 - Class library released under GPL
 - ~ 96 % of functionality
 - ~ 4 % licensed by Sun from 3rd parties
- June 2007
 - IcedTea project launched
- November 2007
 - Red Hat announced agreement with Sun Microsystems (TCK license agreement etc.)
 - Porters group was created - BSD port, Mac OS X port...



History

- December 2007
 - Revision control moved from TeamWare to Mercurial
- May 2008
 - OpenJDK included in Fedora 9 and Ubuntu 8.04
- June 2008
 - IcedTea6 passed TCK tests - fully compatible Java 6 implementation
- July 2008
 - Debian accepted OpenJDK-6 in unstable
- August 2008
 - OpenJDK 7 on Mac OS X and *BSD systems



IcedTea



“True” Open Source Java

- Started by Red Hat
- Team was working on gcj / classpath
- Sun released OpenJDK based on Java 1.7 (May 2007)
- Mostly free but with around 4% encumbered classes
- IcedTea announcement June 7, 2007
- Respect the OpenJDK trademark
- Built with exclusively free software and tools



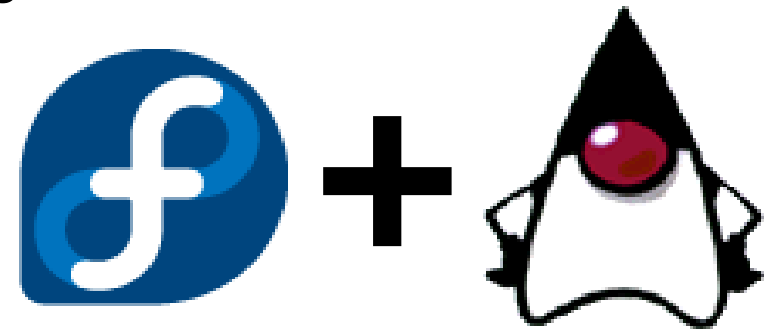
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OpenJDK



IcedTea Project

- Build with exclusively free software and tools
- Provide development infrastructure
 - Mercurial repo
 - Wiki
 - Mailing lists
 - Bug database
 - Code drop hosting
- Replace encumbrances with Free Software
- Porting
- ***Goal: IcedTea in Fedora***
- ***Now Fedora uses IcedTea6***



IcedTea - compiling

- Default Build requirements (F10)
 - autoconf automake gcc gcc-c++ ant cups-devel xorg-x11-proto-devel libjpeg-devel giflib-devel libXt-devel libXp-devel libXpm-devel libXext-devel libXinerama-devel libXrender-devel libpng-devel libXtst-devel freetype-devel alsa-lib-devel xulrunner-devel-unstable gtk2-devel patch xalan-j2 wget
- Only open-source packages!
- More info
 - http://icedtea.classpath.org/wiki/Main_Page



IcedTea - compiling SDK & JRE

- `hg clone`
<http://icedtea.classpath.org/hg/release/icedtea6>
- `cd icedtea6-1.6`
- `./autogen.sh`
- `make`
- Results:
 - SDK image
 - `icedtea6/openjdk/build/linux-platform/j2sdk-image`
 - JRE image
 - `icedtea6/openjdk/build/linux-platform/j2re-image`



Who we are?



Red Hat OpenJDK Team

- Andrew Haley: technical lead
- Lillian Angel: security, core packaging, managing interns
- Deepak Bhole: browser plugin, packaging
- Gary Benson: porting
- Andrew Hughes: performance, Java 7
- Jon VanAlten and Man Wong: interns
- Patrick Macdonald: manager
- Pavel Tišnovský, QA, JCK, test tools, testing
- Martin Matejovič, QA, JCK, packaging



Emeritus and Friends

- Tom Fitzsimmons: community, plugins
- Keith Seitz: jck
- Mark Wielaard: all around good guy



Our Goals

- Open and free JDK [a journey started long ago]
- Best performing JDK on RHEL
- Improved supportability
- Improved performance of JBoss and other Red Hat java apps
- Community involvement



IcedTea Timeline - Java 1.7

- June 7, 2007 IcedTea 1.0 Released
 - Bootstraps with Free Software tools
 - Depends only on Free Software available in Fedora
 - Encumbrances replaced with stubs
 - Autotools build system
- July 13, 2007: **1.1**: GNU Classpath crypto providers
- July 31, 2007: **1.2**: Font and Graphics support
- Aug 28, 2007: **1.3**: gcjwebplugin support
- Oct 12, 2007: **1.4**: Use system timezone data
- Jan 03, 2008: **1.5**: ppc/ppc64 interpreter
- Feb 13, 2008: **1.6**: libffi interpreter for all architectures
- June 02, 2008: **1.7**: synced with IcedTea6 1.2



IcedTea in Fedora [Java 1.7 based]

November 8, 2007: Fedora 8 Release Includes IcedTea



IcedTea Timeline - Java 1.6

- Remove the changes between 6 and 7 so that we could run the testsuite
- February 15, 2008: IcedTea6 1.0 Released
 - IcedTea adapted to OpenJDK 6 code base
- Subsequent releases on April 4, May 28, Oct 15, Oct 27
- Work on Java 7 based IcedTea on hold
- OpenJDK 6 / IcedTea released in Fedora 9 and Fedora 10



IcedTea Timeline - Java 1.6

- Internal Java TCK [JCK] effort
- 19 June 2008: Passed JCK on x86 and x86_84 on Fedora 9, results submitted to Sun
- Plugins, Porting and Performance
- The first (unpatched) OpenJDK 6 from Sun to pass JCK testing was b13, Dec 3 2008. Jan 2009: OpenJDK in RHEL 5.3, fully certified Java compatible
- July 2009: Ubuntu, following Red Hat's instructions and JCKDistilled (of which more later), finally announced that they had managed to pass the JCK



OpenJDK Development and Packaging

- A key responsibility
- Not as simple as packaging what we get from upstream because upstream (still!) doesn't build on Free systems
- To make OpenJDK work on Red Hat / Fedora, we maintain a fairly significant divergence from upstream; some 31k lines of patches
- We're working with Sun to close the gap
- Some of these divergences are due to our need to use system shared libraries rather than statically linking everything



OpenJDK

Testing



Java SE TCK (aka JCK) Testing

- Significant effort
- JCK test results are only valid for a particular combination of compiled binaries and operating system
- The JCK is very hard to set up
 - it took 2-3 months to pass all the tests
 - the maximum number of test failures is 0
 - 300+ page TCK manual to read
 - configuration in many cases is critical
 - tests every service that Java programs can use, so requires many servers to be set up
 - about 60k tests (compiler + devtoos + runtime)
- Complete JCK run now takes about one day on 8 core machine



JCK Testing

- June 2008: Passed the JCK
- We were the first Linux distro to do so, and to date the *only* Linux distro that is certified
 - Ubuntu, Debian, SuSE, do not ship certified Java. (Unless they've passed the JCK and not told anyone!)
- Smaller distros do not have the ability to run the JCK on their own
- Created a wiki for other distros detailing how to avoid our pain
 - <http://icedtea.classpath.org/wiki/JCKDistilled>



JavaTest Harness: JCK6b-compiler: /jck/work

File Configure Run Tests Report View Tools Windows Help

View Filter: Status of All Tests Edit Filter...

Test Suite Root

- [-] api
 - [-] java_rmi
 - [-] Naming
 - [-] index.html#Bind
 - [-] index.html#List
 - [-] index.html#Lookup
 - [-] index.html#Rebind
 - [-] index.html#Unbind
 - [-] registry
 - [-] rmic
 - [-] server
 - [-] CreateTest.html
 - [-] javax_annotation
 - [-] javax_lang
 - [-] lang
 - [-] ANNOT
 - [-] ARR
 - [-] BINC
 - [-] CLSS
 - [-] clss001
 - [-] clss002
 - [-] clss003
 - [-] clss004
 - [-] clss005
 - [-] clss006
 - [-] clss007
 - [-] clss008
 - [-] clss009
 - [-] **clss010**
 - [-] clss011
 - [-] clss012
 - [-] clss013
 - [-] clss015
 - [-] clss016
 - [-] clss017
 - [-] clss018
 - [-] clss019

Folder: lang/CLSS/clss010

Summary Documentation Passed Failed Error Not Run Filtered Out

Selected Folder: clss010
 Selected View Filter: All Tests
 Unfiltered view of the test suite and results in the work directory.

Passed	25
Failed	1
Error	0
Not Run	19
Sub-Total	45
Filtered Out	0
Total	45

There are some failed tests in this folder.

Work Directory: work Configuration: compiler-config.jti Template: None

Finished test run. Elapsed Time 00:48:34

JCK6b-compiler JCK6b-compiler [2]



Machine 'rhel5_32bit'

20090630-1	Result location:	http://file.brq.redhat.com/~ptisnovs/jck/rhel5_32bit/20090630-1/		
	Test suite	Passed	Failed	Error
	compiler	19996	12	0
	devtools	not run	not run	not run
	runtime	not run	not run	not run
20090714-1	Result location:	http://file.brq.redhat.com/~ptisnovs/jck/rhel5_32bit/20090714-1/		
	Test suite	Passed	Failed	Error
	compiler	20008	0	0
	devtools	17566	0	0
	runtime	59021	0	0
20090720-1	Result location:	http://file.brq.redhat.com/~ptisnovs/jck/rhel5_32bit/20090720-1/		
	Test suite	Passed	Failed	Error
	compiler	20008	0	0
	devtools	17566	0	0
	runtime	59021	0	0
20090813-1	Result location:	http://file.brq.redhat.com/~ptisnovs/jck/rhel5_32bit/20090813-1/		
	Test suite	Passed	Failed	Error
	compiler	20008	0	0
	devtools	17537	29	0
	runtime	59020	0	0



OpenJDK

Support for Linux



OpenJDK Support for Linux

- Browser plug-in support
 - Despite the fact that for many people a web browser plugin is the fundamental reason they need Java, it is not part of OpenJDK. We've had to provide the plugins ourselves
 - There are two parts to the plugin: LiveConnect, which is a Java-to-Javascript bridge, and the Java applet plugin proper
 - Some security implications
 - In particular it means that we are the upstream for security fixes, not Sun



OpenJDK Support for Linux

- Audio support
 - PulseAudio support for OpenJDK
 - We integrated Gervill (a software synthesizer) with OpenJDK to replace the proprietary MIDI backend
- We'd like to push all of this upstream, but it's very difficult
 - There's not really a group at Sun really dedicated to making everything work well on Linux, so we have to do it ourselves.
 - They're getting better at this, and our effort should go down over time



OpenJDK

Porting



OpenJDK Porting

- OpenJDK is only available from Sun on x86 (-32, -64) and SPARC
- Need (for Fedora) ARM and PPC (-32, -64)
- Sun ports of Java have always contained significant amounts of assembly code.
- We've created a zero-assembler port (called Zero) that is used in Fedora where a full OpenJDK port is not available
 - Main developer: Gary Benson
 - Functionally fine but it's slow



Zero-assembler port

- Most of Sun's Java interpreters are written in assembly language
- Sun's Java has always used assembly language to interface between the interpreter and native code
- However, Sun had a C++ interpreter that wasn't originally included in OpenJDK but we persuaded them to release it
- We wanted a port of OpenJDK that would work everywhere, with no porting at all
- Zero does just that: the missing part [calls between native and interpreted code] is provided by libffi
- **Every platform with a libffi port can run OpenJDK**
- Zero is provided on many Linux platforms, even recently being used successfully on S/390
- However... it is rather slow
- Zero has been submitted for inclusion in JDK 7.



Shark

- LLVM provides a JIT compiler
- Use the LLVM JIT compiler to generate code for a variety of platforms thus greatly reducing the time to port OpenJDK
 - Shark isn't yet stable, but initial benchmarking suggests that the performance, while not as good as the OpenJDK JIT, is much better than that of the C++ interpreter
 - There's still a lot of low-hanging fruit for optimization
 - Shark is potentially very good indeed but it's a matter of how much work people want to do. **We'd like the community to take it up**
 - Many of the optimizations that are used in the HotSpot native ports could also be used in Shark
- Shark is not totally LLVM-specific: someone could port it to some other JIT compiler



Zero & Shark

- More info:
 - <http://icedtea.classpath.org/wiki/ZeroSharkFaq>



Security updates

- Standard embargo procedures
- Sun have their internal database and send us advance mail of security holes
- We take patches and build RPMs in a private repository
- These RPMs are released at the end of the embargo
- We do this in conjunction with the Red Hat security team [as with the proprietary JDKs]
- Last updates included in IcedTea6 1.5.3 (official RPM for RHEL)



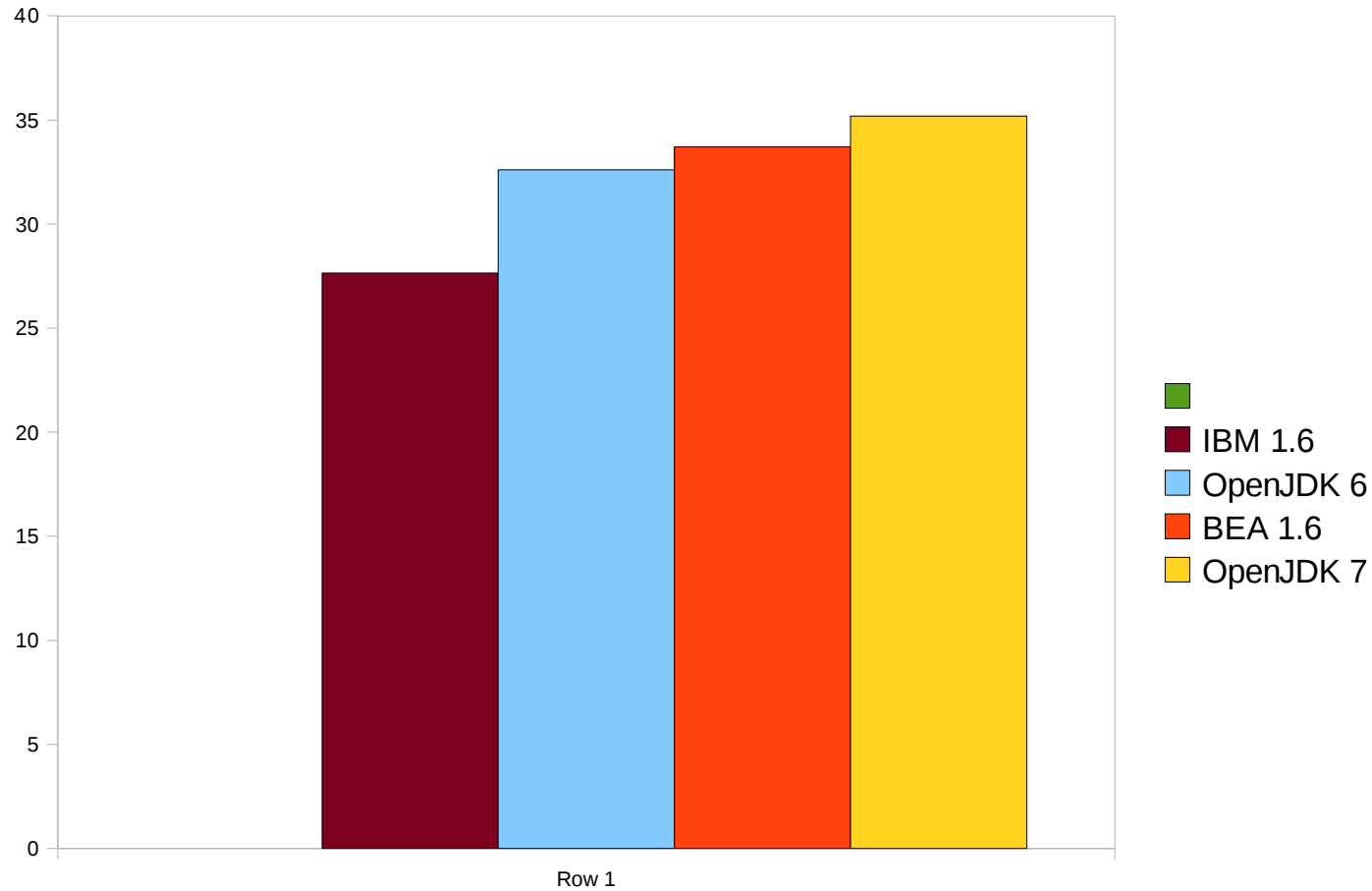
OpenJDK

Performance



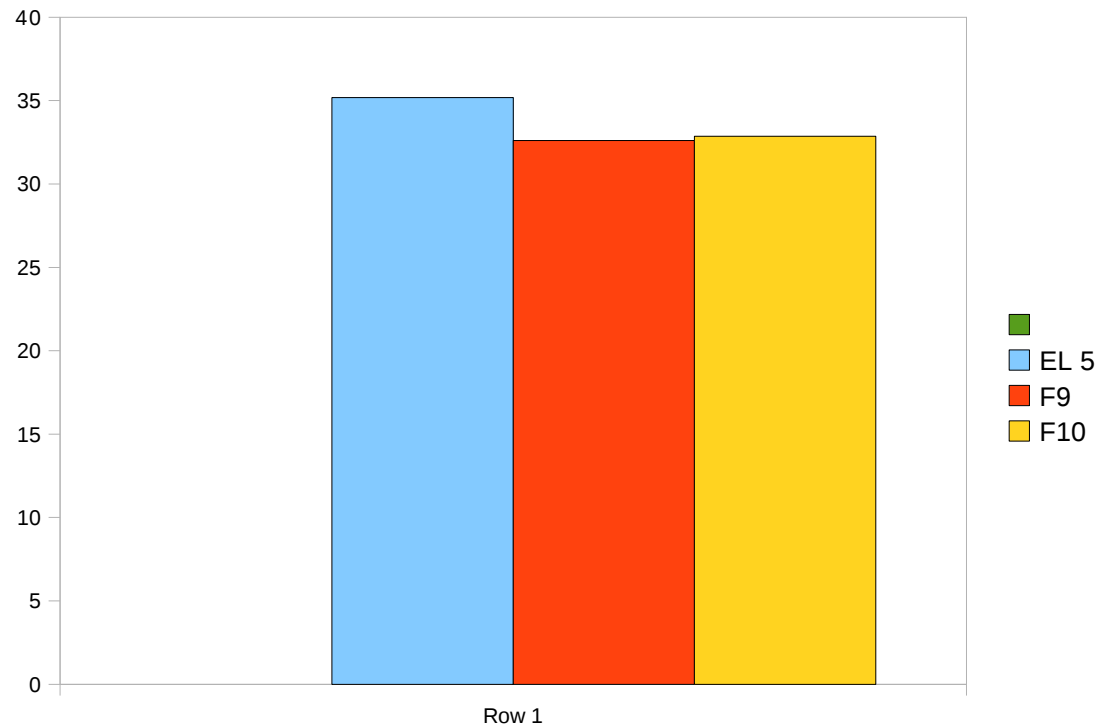
Raw VM performance

SPEC jvm98, x86_64, in SPEC ops/m:



Raw VM performance (cont.)

- But we have seen decreasing VM performance with newer kernels. OpenJDK 7:

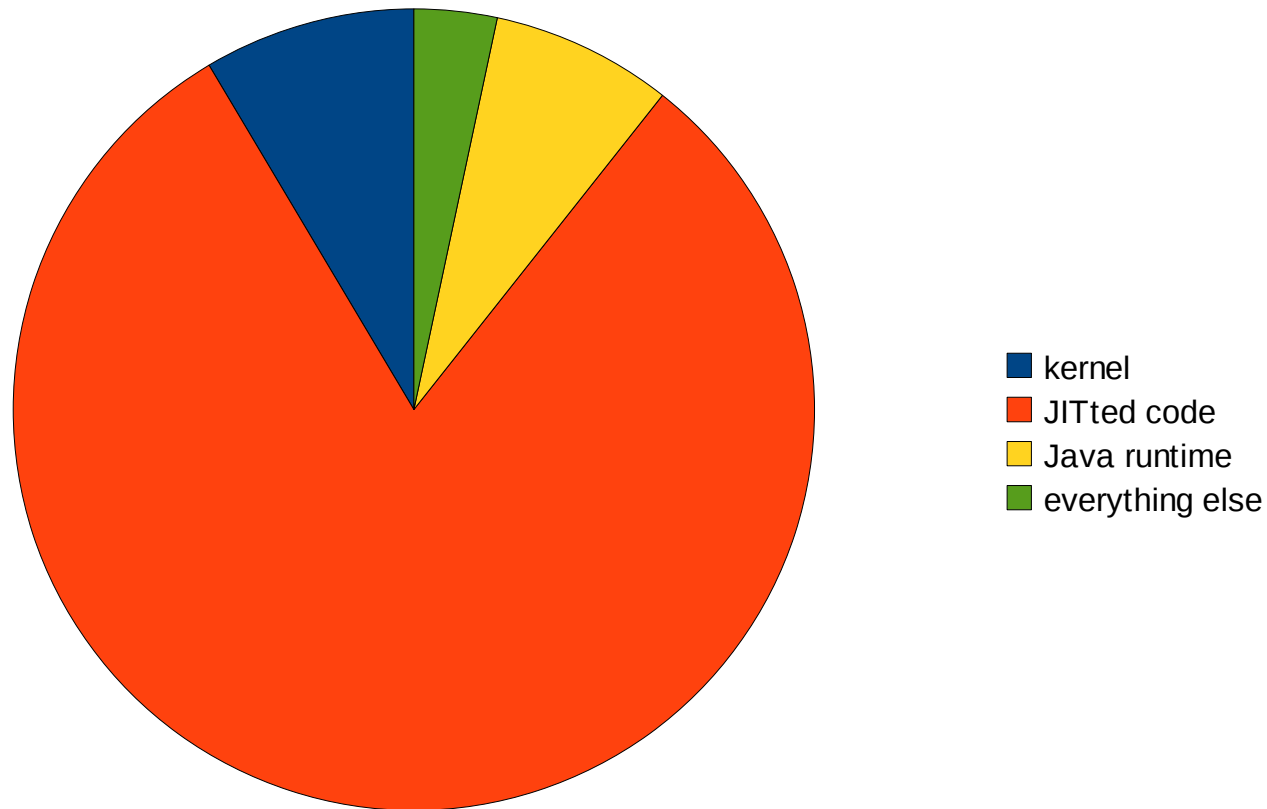


We don't think this is to do with CFQ, but we don't know what really causes it



Benchmarking

SPECjvm 2008 test:

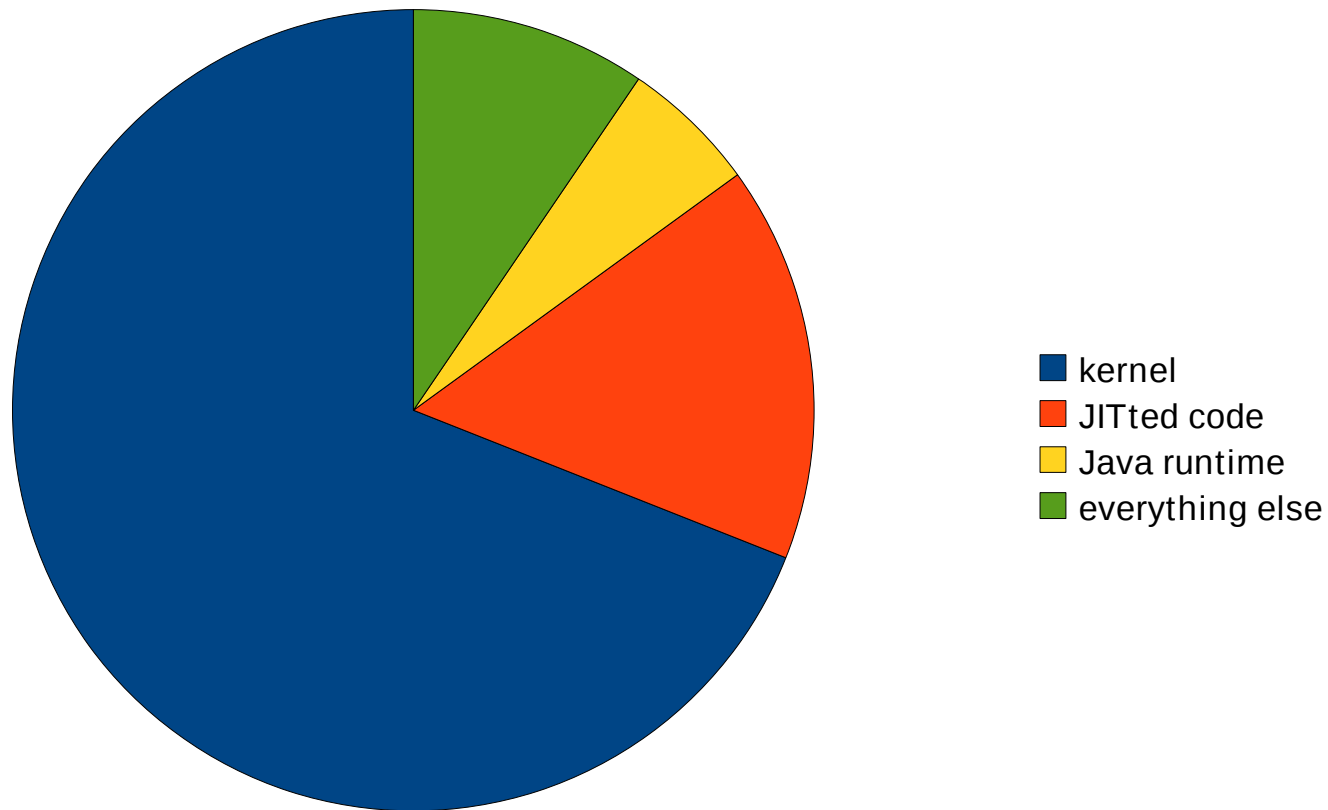


This is an extreme case as it's just testing the VM in isolation



Whole system performance

JGroups test:



This is an extreme case (again :-)) as it's just messaging with no underlying database, but it shows that we shouldn't obsess about JIT performance to the exclusion of everything else



URLs of Interest

- OpenJDK

<http://openjdk.java.net>

- IcedTea

<http://icedtea.classpath.org>

- Our Work List

<http://intranet.corp.redhat.com/ic/intranet/JavaProjectOpenJDK.html>

- JCK Distilled

<http://icedtea.classpath.org/wiki/JCKDistilled>

- Zero and Shark

<http://icedtea.classpath.org/wiki/ZeroSharkFaq>



IRC

- irc.oftc.net
- Channel [#openjdk](#)

You are welcome!

