News in JDK8

Developer Conference Brno Feb. 2012

Jiří Vaněk

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- **FOSDEM** 2012:
  - M. Reinhold: “There is nothing sure right now”
- Q: JDK 7 ?
- Q: JDK < 6 ?

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Brief history of java ...or not all was there from beginning

wikipedia

JDK 1.0 - 1996

- Codename Oak. **Initial** release after **aprox. 4 years of development**, The first stable version was JDK 1.0.2. is called Java 1
- Netbeans started as project Xelfi in CZ
- Each of the releases promised to have some **mayor improvements** and some of them as **leading changes** and some of them will be of non-technical character

Brief history of java 3/9

JDK 1.2 - 1998

- strictfp keyword
- Swing integrated
- **JIT compiler for the first time**
- **Java Plug-in**
- Java IDL, an IDL implementation for CORBA interoperability
- **Collections framework**
- Differences of J2SE x J2ME x J2EE

Brief history of java 4/9

JDK 1.3 - 2000

- **HotSpot** JVM included (the HotSpot JVM was first released in April, 1999 for the J2SE 1.2 JVM) => performance!
- RMI was modified to support optional compatibility with CORBA
- **JavaSound**
- Java Naming and Directory Interface (**JNDI**) included in core libraries (previously available as an extension)
- Java Platform Debugger Architecture (**JPDA**)
- Synthetic proxy classes
- NetBeans as we know them now

Brief history of java 5/9

JDK 1.4 - 2002

- **assert** keyword
- **regular expressions** modeled after Perl regular expressions
- **exception chaining** allows an exception to encapsulate original lower-level exception
- Internet Protocol version 6 (**IPv6**) support
- non-blocking IO (named **NIO**) (New Input/Output)
- **logging** API
- **image I/O** API for reading and writing images in formats like JPEG and PNG
- integrated XML parser and XSLT processor (**JAXP**)
- integrated **security and cryptography extensions** (JCE, JSSE, JAAS)
- **Java Web Start** included
- Preferences API (java.util.prefs)
- **Conquering EE** world and rise of **GNU classpath** (GIJ, GCJ, rt.jar)

Brief history of java 6/9

JDK 5.0 - 2004

- Changed versioning
- **Generics**
- Metadata (**annotations**)
- **Autoboxing**/unboxing:
- **Enumerations**
- **Varargs**: (public void (String...s){})
- Enhanced **for each** loop (for (Widget w: widgets){})
- Static imports
- Swing: New skinnable **look and feel, called synth**.
- The concurrency utilities and Scanner class
- Java 5 is the last release of Java to officially support the Microsoft Windows 9x **;)**
- **Eclipse opensourced**

Brief history of java 7/9

JDK 6 - 2006

- Another versioning change, and release of **OpenJDK** and in 2007 rise of project IcedTea
- Contributions?
- **Scripting** Language Support (eg. Rhino for javascript)
- Dramatic **performance** improvements for the core platform and Swing.
- JAX-WS and JDBC 4.0
- Java Compiler API - an API allowing a Java program to select and invoke a Java Compiler programmatically.
- Upgrade of JAXB 2.0 and StAX parser.
- Support for pluggable annotations
- Many GUI improvements, such as integration of **SwingWorker** in the API, **table sorting and filtering**, and true Swing **double-buffering**
- JVM improvements include: synchronization and compiler performance optimizations, new algorithms and upgrades to existing garbage collection algorithms, and application start-up performance
- **Acquisition** 2009/2010 maintainer of JDK changed from **Sun** to **Oracle**

Brief history of java 8/9

JDK 7 - 2011

- First oracle release, although presented proudly, only minor updates at all, and first version **was bugy.**
- JVM support for **dynamic languages (invoke dynamic)**, following the prototyping work currently done on the Multi Language Virtual Machine
  - JRuby/Scala/... call directly to JVM (and no transformation to java at first)
  - Via custom code which JVM inline through
- Compressed 64-bit pointers
- Small language changes (grouped under a project named **Coin**):
  - **Strings in switch**
  - Automatic resource management in try-statement (eg **AutoCloseable**)
  - Improved type inference for generic instance creation (eg <>)
  - Simplified varargs method declaration
  - Binary integer literals and spaces/underscores in numeric literals
  - Catching **multiple exception** types and rethrowing exceptions with improved type checking

Brief history of java 9/9

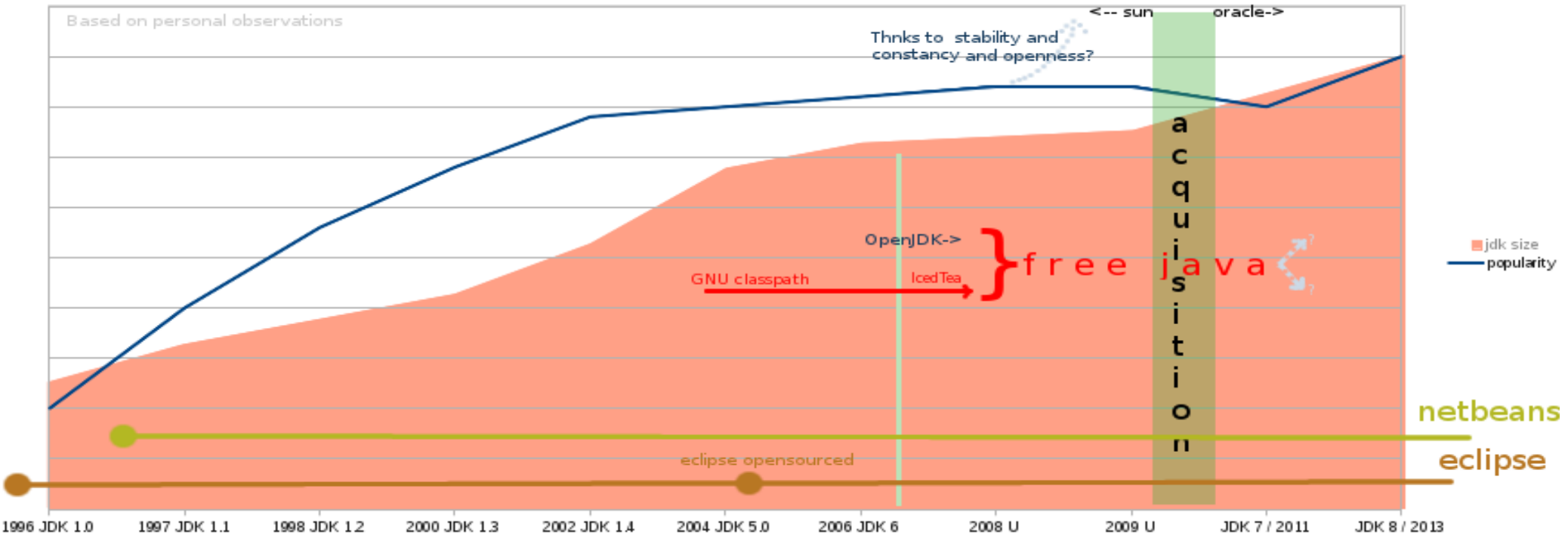
JDK 7 - continue

- Concurrency utilities (fork/join framework)
- New file I/O library to enhance platform independence and add support for metadata and symbolic links. The new packages are **java.nio.file** and java.nio.file.attribute
- Library-level support for Elliptic curve cryptography algorithms
- An **XRender pipeline** for Java 2D, which improves handling of features specific to modern GPUs
- New platform APIs for the graphics features originally planned for release in Java version 6u10
- Enhanced library-level support for **new network protocols**, including SCTP and Sockets Direct Protocol
- Upstream updates to XML and **Unicode**
- **OpenJDK** is build-able without additional projects
- Care is taken of **community**

JDK 8 - 2013

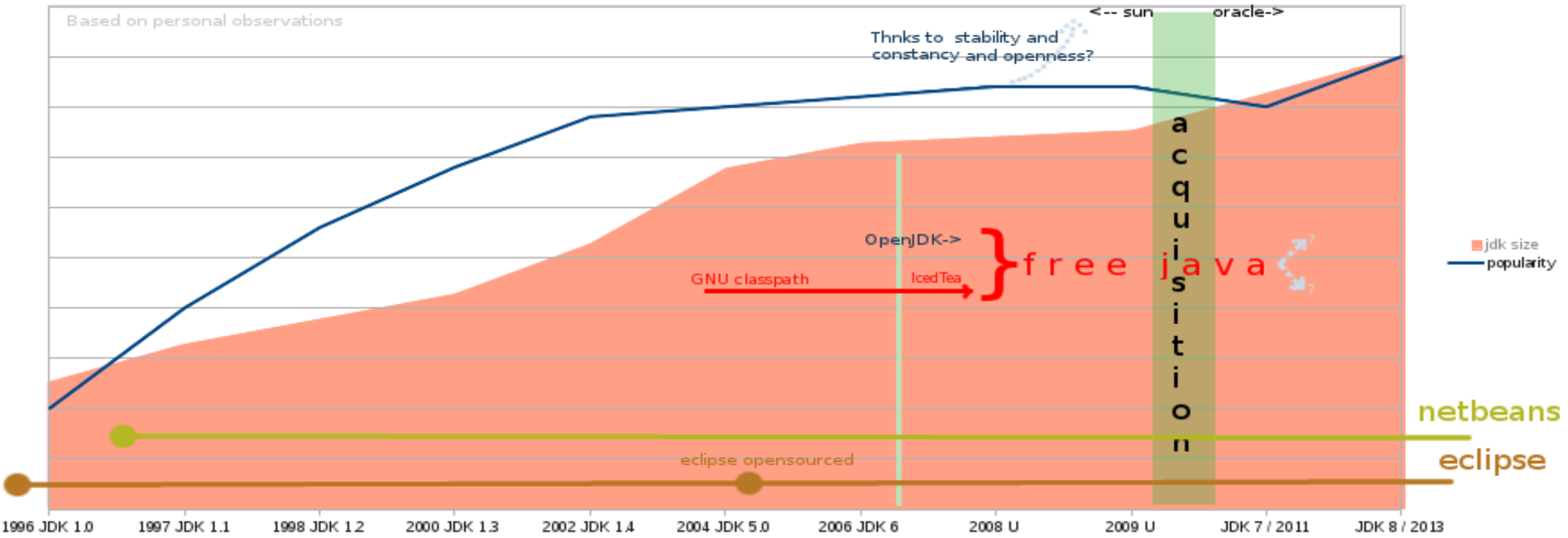
- Finish JDK7
- and much more!
- already now under more work then JDK7
- Even better care **of community**

Summary 1/2



- Long way to OpenJDK 8! (**13+4 years**, and IBM is still supporting 1.4! (And oracle via very expensive support too))
- New release aprox. Every 2 years
  - Longest not-replaced release java 6 – 5 years
  - Caused by changing of maintainer from Sun to Oracle in 2009/2010?
- Each release have at least one mayor improvement
- Hugest release was (by surprise!) JDK 5.0
- **Oracle** looks to keep **2 years** period,is preparing **valuable changes**... This going **better** after long break!

Summary 2/2



- Small decrease of popularity when JDK7 was released was caused by unwillingness of developers to try changes (and by some mayor bugs O:)
- **Most (young) developers imagine under “java” release “JDK 6”, can not even imagine evolution!**
- Oracle is **maintaining community** (LCJ – community process to maintain community), is preparing valuable changes... This going **better** after long break!

OpenJDK7 -> OpenJDK8

or what did not affect (or Plan B)

Future Of Java and Mark Reinholds's keynote (2011)

Project Coin	- >	**Project Coin (finish)**
Invoke Dynamic		
Fork/Join Framework		
(Penrose)	---------->	**Project Jigsaw**
	---------->	**Project Lambda**
	+	**Merge of HotSpot and JRocket**
	+	**Java FX 3.0**
	?+?	***Project Avatar***(full HTML 5 support) ->9?
	?+?	**Graal**
Strict Verification		
Parallel Class Loaders		
Phasers		
Transfer Queues		
More New I/O		
Unicode 6.0		
Enhanced Locales		
SDP & SCTP		
TLS 1.2		
ECC		
JDBX 4.1		
Xrender Pipeline		
Swing JLayer		
Swing Nimbus		
(EE) cache api (finally!)	---------->	(EE?)Datagrid api (jsr 347)
	---------->	Type Annotations
	---------->	Bulk Data Operations
	+	New Date/Time api
	+	Multi-touch devices
	+	Rewritten javascript engine (project Nashorn)
	+	Easier Java/Native integration ->9

OpenJDK 8

2013 (?)

- JDK7 was **very conservative** release
- JDK8 should be **big** update
- But developers see JDK7 as big set of changes. So?
- just finish 7? Hopes that not...

  eg modularisation via project Jigsaw will be **the change**.
- Or will it achieve revolution instead of evolution?
- **FOSDEM** – no news:(
  - M. Reinhold: “There is nothing sure right now”
- JDK8 compared to JDK7 (compared to JDK6) have great improvements in **infrastructure** and **community** maintaining
  - LCJ – community process to maintain community
  - JEP – features proposal process
  - Community more involved into JSR process (eg.: approving or “adopt your JSR”)

OpenJDK8 - Project Coin 1/2

J.Darcy's blog and draft

- Gathering name for couple of small language changes
- Most already done in JDK7:
  - **Strings in switch**
    - Fastened by **hashcode** on byte code level (hashcodes compared first)
    - String s; switch(s){ case "april":...}
  - **Multi-catch** and more precise rethrow
    - catch (MyEexception || TheirsException){}
  - Improved type inference for generic instance creation (**diamond**)
    - List<String> a=new ArrayList<>
  - try-with-resources statement (**AutoCloseable**)
    - try (AutoCloseable q= new MyAutoCloseable())
      {q.do()};
      //and ... q is closed, and exceptions handled
  - Simplified varargs method invocation
    - @SafeVarargs
  - **Binary** integral literals and **underscores** in numeric **literals**
    - Eg int a=0b10010; int b= 1 000_000;

OpenJDK8 - Project Coin 2/2

- To be done in JDK8:
  - Language support for **collections** (access **through []**)
    - **Eg** List<String> a;...; String q=a[5];
  - **Elvis** and other **Nullsafe operators** (in case that subject is null then nothing upon him will be invoken, and no exception thrown)
    - JDK9?
    - To be done at all?
    - Currently implemented as variations of “?”
      - a?.foo();
      - Or a ? a : b
      - Or a ?: b
  - Large **arrays** - declaration via **long** (currently maximally via int)
    - Long l=15; String[] s=new String[l]

OpenJDK8 - Project Jigsaw 1/4

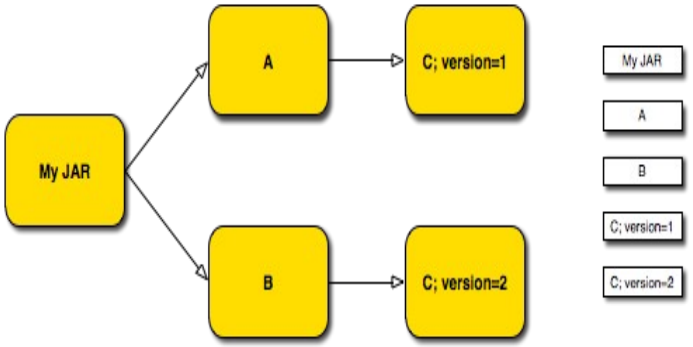
draft

- Leading change in JDK8 – **modularisation of java platform**
- Continuous integration into JDK7 via project penrose (approved Jan/Feb 2012)
- Probably hugest change since JDK1
- Current JDK is **monolithic** and **huge** (more then 100M)
- Modules **will replace class path** (unix and maven like approach)
  - Eg. by Maven - Build-time, install-time, test-time and run-time
  - Eg from packages – shared versions and modules
  - Inspired and compatible with OSGI
- Modularization of native-binary parts of JDK will probably comes up to JDK9 :(

OpenJDK8 - Project Jigsaw 2/4

[solution]

- What it should solve:
  - JAR hell
    - Too many **transitive** references
    - Dependence on **multiple versions**



    - Unmanaged Dependencies (only via **classloaders** hierarchy) => ServiceLoader API
    - Use of **private code** – no longer possible?
    - Stomping – **name clash** in jars

OpenJDK8 - Project Jigsaw 3/4

- Platform fragmentation
  - Will allow unification of SE x ME and EE
  - **No more rt.jar** (separate jats for separate technologies – swing, xml, language...)
- **Startup** performance
  - (**pre**)loading only what needed (**pre-downloading**?)
  - Already JDK6 have lazy loading of parts of RT (but still whole RT must be available)
- Integration with **native packaging** systems
  - Rpm/deb... inspiration <-> compatibility
  - Support for better cooperation with native modules probably moved to JDK 9
- Package granularity
  - Libraries consisting from more and more jars?
  - Can lead to “new” “**modules hell**” ?

    (lot of work done to not so)
- What is module?

OpenJDK8 - Project Jigsaw 4/4

jigsaw big picture and lang.support

- Descriptors are **plain-text .java** files "inside" module/jar
- Module declaration:

```
module a.b @ 1.0 {
 requires       c.d @ /* Use v2 or above */ >= 2.0 ;
 requires service e.f;

 provides       g.h @ 4.0;
 provides service i.j with k.l;
 exports  m.n;
 permits  o.p;
 class    cc.dd;

 view a.b.c {
  provides       q.r @ 1.0;
  provides service s.t with u.v;
  exports  w.x;
  permits  y.z;
  class    aa.bb;
 }
}
```

Maven --->
(pom compatibility)

---->jar
(classical,
classpath re-usable jar)

---->jmod

---->rpm

---->deb

---->war,ear (JDK 9?)

OpenJDK8 - Project Lambda 1/2

introduction, draft

- Known also as **Closures,** close connection to JDK7's invoke dynamic
- Anonymous functions:
  - Eg: #()(42) **is** int getMeaningOfLive(){return 42}
  - Eg: #(int x,int y)(x*y) **is** int multiply(){return x*y}
- -> lambda operator
  - Squarer<Integer, Integer> s = (x) -> x * x;// 1-ary Lambda expression
    System.out.println(s.square(5));
  - Anonymous call: (x,y)->x*y
- default keyword
  - Defenders methods - Default implementation of method in interface
  - "breakng" interface pureness, but still forbid fields
  - When implementing more interfaces, must be declared directly
- What is it for? – **parallelism** and **bulk data operations**

OpenJDK8 - Project Lambda 2/2

1)

```
Class Student {
  String name
  Int gradYear;
  Double score
};
```

2)Naive implementation of searching

```
List<Student> students = ...;

double max= Double.MIN_VALUE;
For (Student s: students){
  If (s.gradYear==2011)
     max=Math.max(max,s.score)
}Return max;
```

3)Task:

```
Double max
     = students.filter
          s.gradYear == 2011
            .map
          s.score
            .reduce
          Mth.max
```

4)JDK6 – set of interfaces:

```
double max= students.filter(new
Predicate<Student>() {public booelan eval(Strudent s)
{
return s.gradYear==2011)
}).map(new Mapper<Student,Double>() {public
Double map(Strudent s){
return s.score)
})..reduce(new Reduce<Double,Double>() {public
Double reduce(Double max,Double score){
Return Math.max(max,score)
}
});
```

Parallelism possible, but...

5)JDK7 – Job for fork/join framework

6) JDK8 – lambda

```
double max= students
.filter((Student s) -> s.gradYear==2011)
.map((Student s) -> s.score)
.reduce(0.0,
          (Double max(Double max,Double score)
        -> Math.max(max,score)
```

And parallelism will come from JDK.

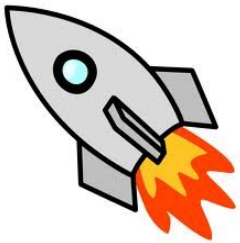
7)result

```
double max= students
.filter(s -> s.gradYear==2011)
.map(s -> s.score)
.reduce(0.0,Math#max) //wrap
```

Without parallelisms lambda implementation is currently slow!

OpenJDK8 - Hotspot convergention

jrockit mission control



HotSpot merge with JRocket

[announcement]

- Merging the best from two leading java virtual machines
- **HotSpot** (Oracle) – faster JIT and much better optimization
- **JRocket** (created by BEA, currently IBM) - more scalable and observable
- Will reach OpenJDK?
- JDK 9?

OpenJDK8 - Java FX (3.0?)

announcement

- Already well know as Dead technology => What benefits can be bring in JDK8
- **Open-sourced and version 3**
- FX 3.0 – extended FXML (Reaction to flex?)
- Inclusion into Java Embedded
- Standardized as JSR
- Full support for **Linux** and Mac OS X

(Open?)JDK8 - Graal

announcement

- Close connection with Invoke dynamic
- Portable, extendable multi-VM JIT written in java
- Personally, I do not believe in Graal.
- JDK9?

(Open?)JDK8 – Project Avatar

announcement

- Full HTML 5 support
- Second step to ME, SE and EE Unification
  - Serialization over JSON
  - Bi-directional “ethernal” web-sockets
- To much shadows and questions about it.
- EE?
- Probably bigger change then jigsaw => I believe to come in JDK9, but some teasers can be available during JDK8, as JDK9 can be to late for first real introduction of HTML5 to JAVA

OpenJDK8 (EE?) – Datagrid API

JSR-347 and JSR-107

- JVM-embeded non-relation-database
  - Same or different one virtual machine
- Current implementation is eg: jboss-comunity infinispan
- Based on oldest unimplemented JSR-107 – Caching API
  - Caching API comes with JDK7 EE

OpenJDK9 – 2015/16?

- **Self tunnig JVM**
- I**mproved Native Integration**
- Big Data
- Reification
- Tail Calls/Continuation
- Meta Object Protocol
- Multi Tenancy
- Resource Management
- Heterogenous Compute model
- **Finish avatar, Jigsaw...**.
- Do you want something? Introduce it via **JEP** – enhancement proposal

- *Sci-fi?*

Conclusion

- There are **small** changes – rest of project Coin
- Strange changes – JavaFX
- Very **interesting** changes – Project Lambda, JVMs merging and Graal
- And **Huge** change under project Jigsaw
- And more huge, but still uncelar changes in Project Avatar
- It will change the perception of java...

  ... Or update like every else before?

  ... Or will become Revolution instead of Evolution?

Questions?

- http://en.wikipedia.org/wiki/Java_version_history
- http://gotocon.com/dl/goto-prague-2011/slides/TerrenceBarr_FutureOfJava.pdf
- http://www.oracle.com/javaone/live/index.html
- http://blogs.oracle.com/darcy/entry/project_coin_final_five
- http://openjdk.java.net/projects/lambda/
- http://openjdk.java.net/projects/jigsaw/doc/draft-java-module-system-requirements-12
- http://cr.openjdk.java.net/~mr/jigsaw/notes/jigsaw-big-picture-01
- http://openjdk.java.net/projects/jigsaw/doc/lang-vm.html
- http://cr.openjdk.java.net/~mr/lambda/straw-man/
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- http://www.wiki.jvmlangsummit.com/images/8/8e/GraalJVMSummit2011.pdf
- http://www.infoq.com/news/2011/10/java-data-grid
- http://www.jboss.org/infinispan and http://jcp.org/en/jsr/detail?id=107

Thank you for your attention!