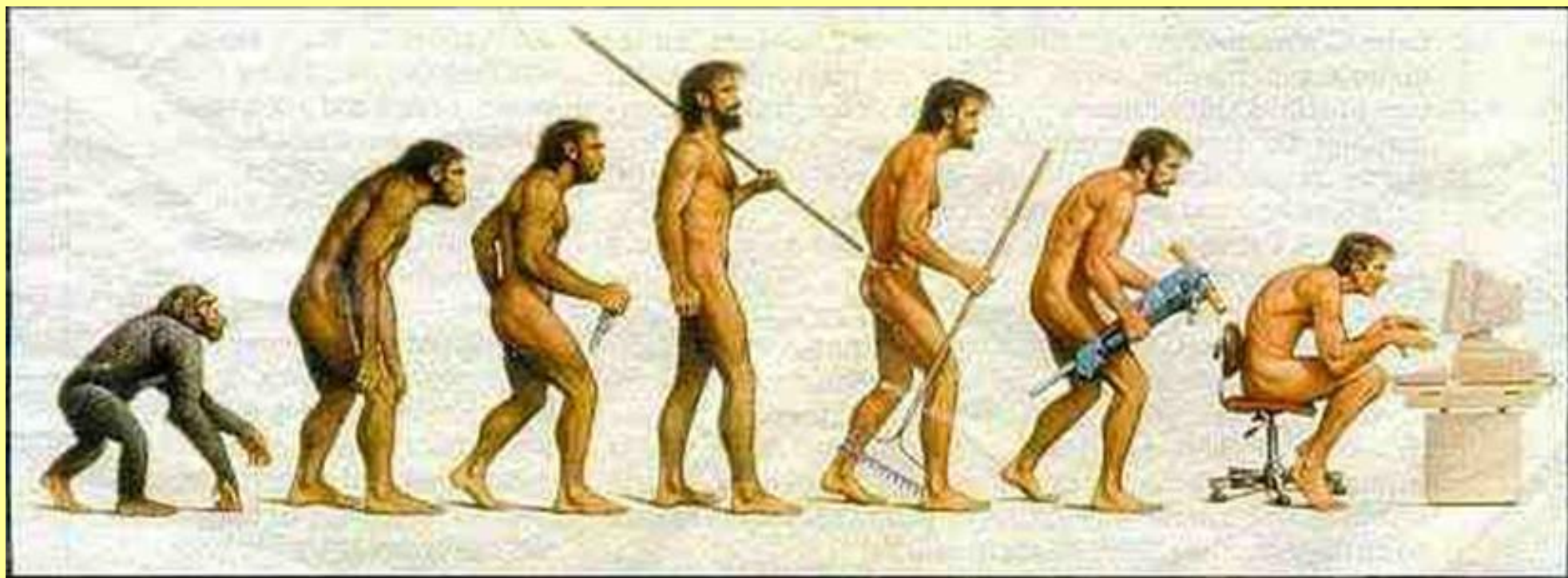


New Features in OpenJDK 7

JDK and OpenJDK (r)evolution



JDK (r)evolution (1)

- 1996 - JDK 1.0
 - Initial release, but the first stable version was JDK 1.0.2
- 1997 - JDK 1.1
 - Inner classes, AWT rewritten, JDBC, remote method invocation (RMI)
 - Syntax changed due to inner classes
- 1998 - J2SE 1.2
 - Swing, JIT, collections
 - Syntax changed due to the new `strictfp` keyword

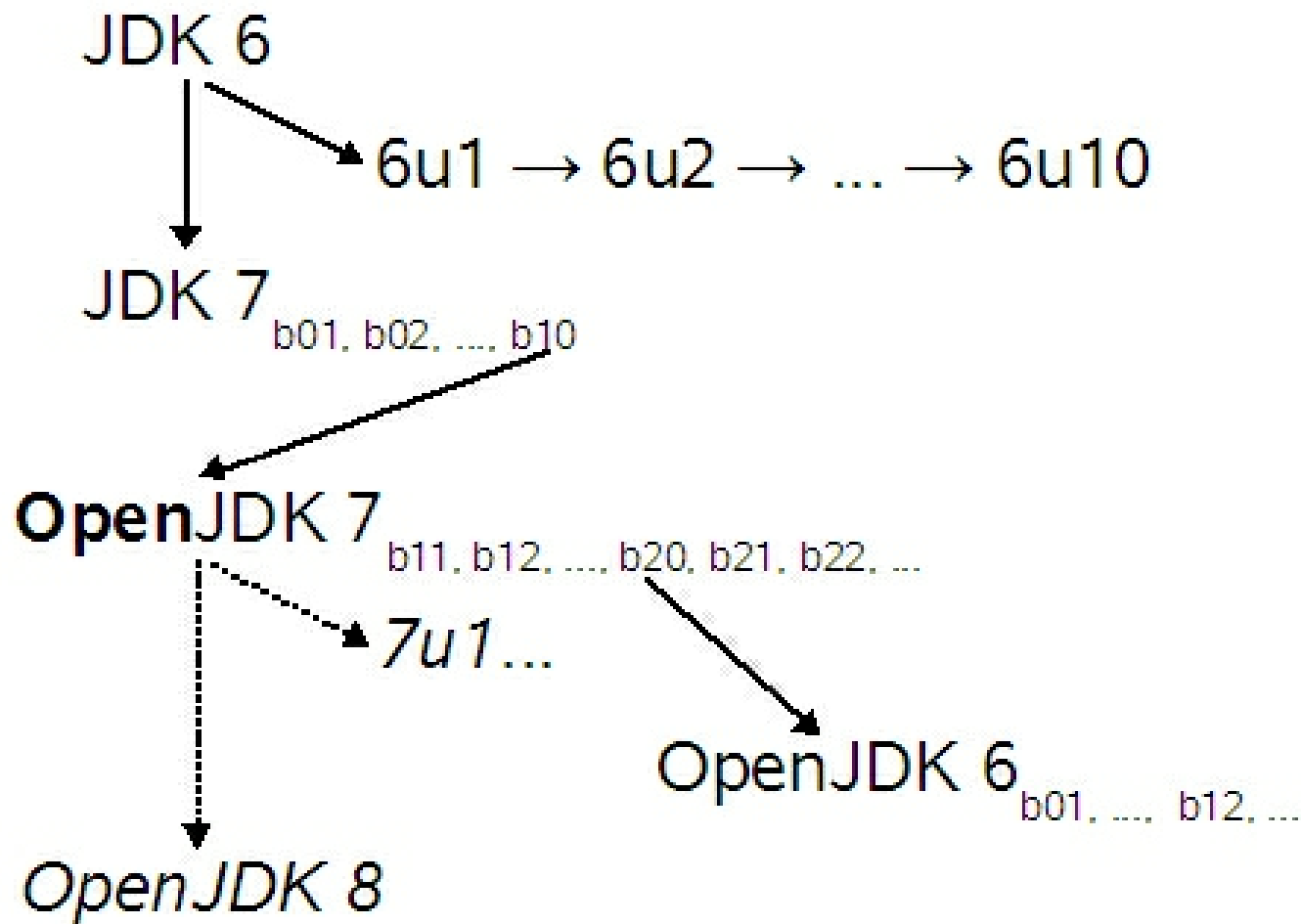


JDK (r)evolution (2)

- 2000 - J2SE 1.3
 - JNDI, JPDA, Hotspot JVM
 - Synthetic proxy classes
- 2002 - J2SE 1.4
 - regexp, JAXP, JWS, NIO, assert
 - Syntax changed due to the new `assert` keyword



OpenJDK evolution



Java language basic principles

- Program code should do what it seems to do
- Reading is more important than writing
 - ▶ X TMTOWTDI preferred by Perl community
- Code should be a joy to read
 - ▶ Well, sometimes...
- Clear relationship between syntax and semantics
 - ▶ Absence of “magic” variables like \$\$, \$_ etc.

(OpenJDK) (r)evolution priorities

- Productivity
 - Get more done with less code
- Performance
 - Multi-core processors are the next target
- Universality
 - More languages at top of JVM
- Modularity
 - CLASSPATH hell
- Integration
- Serviceability
 - Monitoring, diagnosing problems...

JDK 7 feature list

- Plan A:
 - ▶ JDK 7 with all previously planned features
 - ▶ Delivery in mid 2012
- Plan B:
 - ▶ JDK 7 (without Lambda, Jigsaw and some features from the Coin project)
 - ▶ Delivery in mid 2011
 - ▶ JDK 8 (Lambda, Jigsaw, the rest of the Coin project, ...)
 - ▶ End of year 2012

... and the winner is ...

Plan B

Schedule

- According to Mark Reinhold (Oracle)
 - ▶ He talked about OpenJDK plans on FOSDEM 2011 conference

Schedule

- Last full test cycle:

2011-06-08

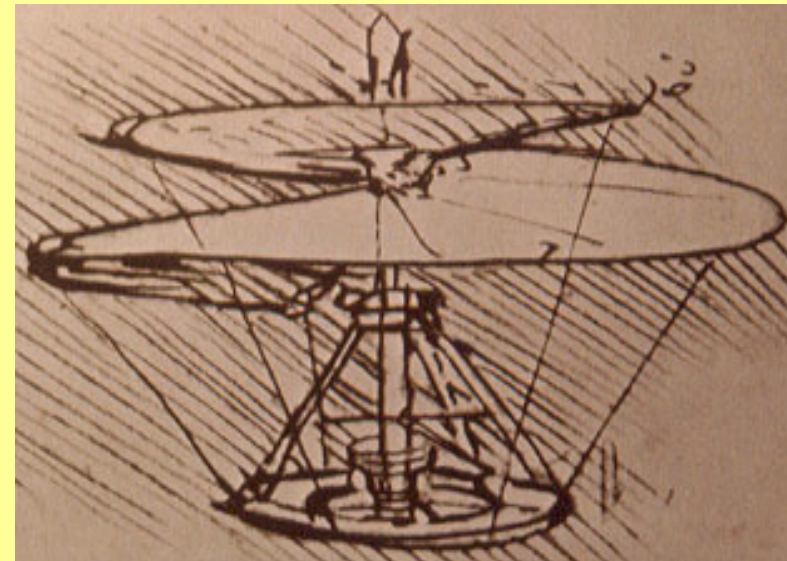
Schedule

- Final release:

2011-07-28

New OpenJDK7 features included in Plan B (1)

- JSR 292
 - Supporting Dynamically Typed Languages
- Project Coin
 - Small Language Changes in JDK 7
- JSR 166y
 - Concurrency Utilities (Collections API changed)
- JSR 203
 - More New I/O APIs for the Java platform (NIO.2)



New OpenJDK7 features included in Plan B (2)

- JSR 203: SCTP
 - Stream Control Transmission Protocol
- JSR 203: SDP
 - Sockets Direct Protocol
- ECC
 - Elliptic curve cryptography
- XRender pipeline support for Java 2D
- Nimbus look-and-feel
 - for Swing applications
- Swing JLayer component

New OpenJDK7 features included in Plan B (3)

- TLS 1.2
- JDBC 4.1
- Unicode 6.0
- Locale
 - ▶ Distinguishing between user locale settings and GUI settings
- NIO.2 filesystem
 - ▶ Support for zip and jar archives
- Windows Vista IPv6 stack
 - ▶ (system dependent)

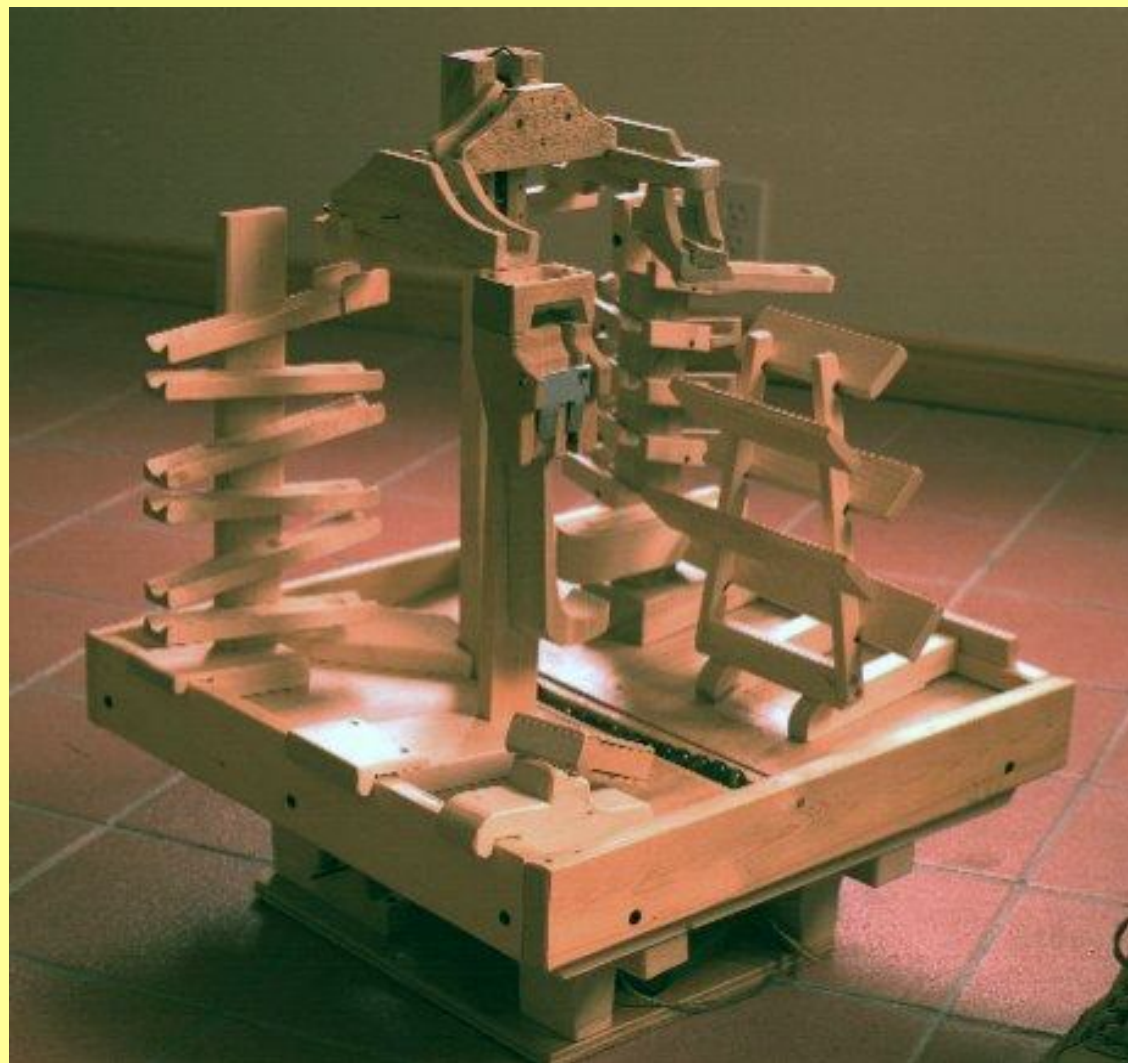
Features postponed to JDK 8 (or 9?...)

- JSR 294
 - Language and VM support for modular programming
- JSR 308
 - Annotations on Java types
- JSR **TBD**
 - Language support for collections
- JSR **TBD**
 - Project Lambda

Features postponed to JDK 8 (or 9?...)

- Modularization
 - Project Jigsaw
- JSR 296
 - Swing application framework
- New Swing component
 - JDatePicker

New features in OpenJDK 7



Unicode 6.0

- Unicode 5.2
 - ▶ October 2009
 - ▶ ISO/IEC 10646:2003 + amendments 1, 2, 3, 4, 5 and 6
 - ▶ 90 scripts
 - ▶ 107.361 characters
- Unicode 6.0
 - ▶ October 2010
 - ▶ ISO/IEC 10646:2010 + Indian rupee sign
 - ▶ 93 scripts
 - ▶ 109.449 characters

Unicode in Java language :-)

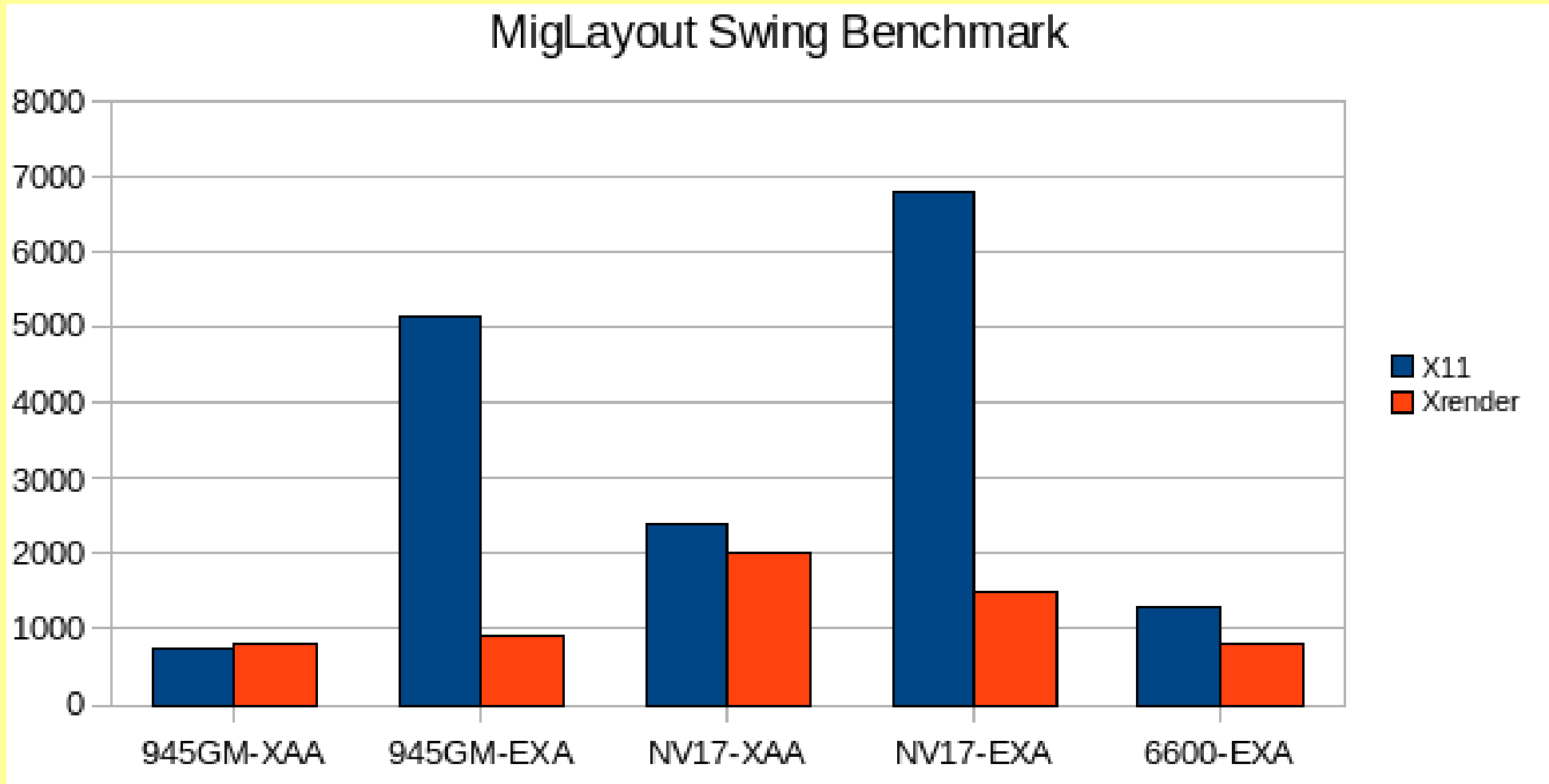
```
public class T
{
    static String система="JVM";
    public static void χῆμῖϚλ()
    {
        System.out.println(система);
    }
    public static void main(String[] args)
    {
        χῆμῖϚλ();
    }
}
```

Support for XRender Graphics Pipeline

- X Rendering Extension
 - ▶ Raster operations (rops)
 - ▶ Including various alpha channel operations
- Font antialiasing
- Graphics accelerator support
- Significant speed-up of some operations



Support for XRender Graphics Pipeline



Support for XRender Graphics Pipeline in IcedTea6?

- XRender code has been backported into IcedTea6!
 - ▶ Fedora 12-rawhide, RHEL 6, Ubuntu...
- backport in form of one big patch
 - ▶ 340 kB :-)
 - ▶ 6307603-xrender-01.patch

Project COIN



Project COIN

Small Language Changes for JDK 7

Project COIN

“Making things programmers do every day easier.”

Project Coin

- Small changes in semantics and syntax of Java programming language
 - ▶ Syntactic sugar in some cases
 - ▶ To speed up day-to-day programming
 - ▶ Inspiration taken from other languages
- No new opcodes in the bytecode instruction set
- No new keywords!

Project Coin

- Small language changes:
 - ▶ Understandable specification
 - ▶ Quite easy implementation
 - ▶ Easier testing
- But not only `java/javac` affected!
 - ▶ NetBeans
 - ▶ Eclipse
 - ▶ ECJ/GCJ...

Eclipse

```
1 import java.util.List;
2
3
4 public class Test {
5     List<String> list = new String<>();
6
7     static {
8         String test = "qwe";
9         switch (test) {
10             case "aaa": break;
11             case "bbb": break;
12         }
13     }
14 }
15
```

Problems

Description	Resource	Path	Location	Type
Errors (2 items)				
The type String is not generic; it cannot be parameterized with arguments <String>	Test.java	/ProjectCoin/src	line 5	Java Problem
Cannot switch on a value of type String. Only convertible int values or enum constants are permitted	Test.java	/ProjectCoin/src	line 9	Java Problem

Writable Smart Insert 5 : 36

Eclipse

The screenshot displays the Eclipse IDE interface. The main editor window shows a Java file named `Test.java` with the following code:

```
1 import java.util.List;
2
3
4 public class Test {
5     static {
6         String test = "qwe";
7         switch (test) {
8             case
9             case
10        }
11    }
12 }
13
```

A red squiggly line is under the `test` variable in the `switch` statement on line 7. A tooltip points to this line with the message: "Cannot switch on a value of type String. Only convertible int values or enum constants are permitted".

The left sidebar shows the Package Explorer with a tree view of the project structure, including folders like `AAATest`, `AutoWindowResizir`, and `ProjectCoin`. The `ProjectCoin` folder is expanded to show the `src` folder containing `Test.java`.

The bottom of the IDE features the Problems view, which shows a table of errors:

Description	Resource	Path	Locator	Type
Cannot switch on a value of type String. Only convertible int values or enum constants are permitted	Test.java	/ProjectCoin/src	line 7	Java Problem

The status bar at the bottom indicates the editor is in "Writable" mode, "Smart Insert" is active, and the cursor is at "10 : 10".

NetBeans

The screenshot shows the NetBeans IDE 6.8 interface. The main editor window displays the following Java code in `Test.java`:

```
1 import java.util.ArrayList;
2 import java.util.List;
3
4
5 public class Test {
6     List<String> list = new ArrayList<>();
7
8     static {
9         String test = "qwe";
10        switch (test) {
11            case "aaa": break;
12            case "bbb": break;
13        }
14    }
15 }
```

The IDE shows a compilation error in the Output window:

```
Created dir: /home/jvanek/NetBeansProjects/JavaProject1/build/classes
Created dir: /home/jvanek/NetBeansProjects/JavaProject1/build/empty
Compiling 2 source files to /home/jvanek/NetBeansProjects/JavaProject1/build/classes
/home/jvanek/NetBeansProjects/srcCompileHang/Test.java:6: illegal start of type
    List<String> list = new ArrayList<>();
1 error
/home/jvanek/NetBeansProjects/JavaProject1/nbproject/build-impl.xml:406: The following error occurred while executing this line:
/home/jvanek/NetBeansProjects/JavaProject1/nbproject/build-impl.xml:196: Compile failed; see the compiler error output for details.
BUILD FAILED (total time: 0 seconds)
```

The error message indicates an "illegal start of type" at line 6 of `Test.java`, specifically pointing to the generic type declaration `List<String>`. The IDE also shows the project structure in the left sidebar, including `Source Packages` and `Libraries`.

Text editors (Vim in this case)

```
Test.java (~/workspace_javatests/ProjectCoin/src) - GVIM
import java.util.ArrayList;
import java.util.List;

public class Test {
    List<String> list = new ArrayList<>();

    static {
        String test = "qwe";
        switch (test) {
            case "aaa": break;
            case "bbb": break;
        }
    }
}

~
~
15,1 All
```

Other compilers (ecj)

```
dhcp-lab-190:~/workspace_javatests/ProjectCoin/src/$ ecj -1.7  
Test.java
```

```
-----  
1. ERROR in Test.java (at line 6)  
List<String> list = new ArrayList<>();  
                                     ^
```

```
Syntax error on token "<", ? expected after this token
```

```
-----  
1 problem (1 error)
```

```
1. ERROR in Test.java (at line 10)  
switch (test) {  
    ^^^^
```

```
Cannot switch on a value of type String. Only convertible int  
values or enum constants are permitted
```

```
-----  
1 problem (1 error)
```

Project Coin

- Binary integer constants
- Optional underscore (_) in numerical constants
- Strings in the **switch** statement
- “Diamond” operator
- Automatic Resource Management (ARM)
- Better exception handling

Project Coin

Some examples shown on the following slides are based on source codes prepared by Joe Darcy (Oracle).

- published with his permission -

Binary integer constants

```
int binary = 0b11001001001;
```

Optional underscore (_) in numerical constants

```
double amount = 1_999_888_777.25;
```

```
int color = 0xdd_dd_dd;
```

```
int binary = 0b110_0100_1001;
```

```
int octal = 0_12_34_56_77
```

Switch statement in Java

- Before JDK 5
 - ▶ Only integer constants allowed

Switch statement in Java

- Before JDK 5
 - ▶ Only integer constants allowed
- JDK 5
 - ▶ + enumeration types

Switch statement in Java

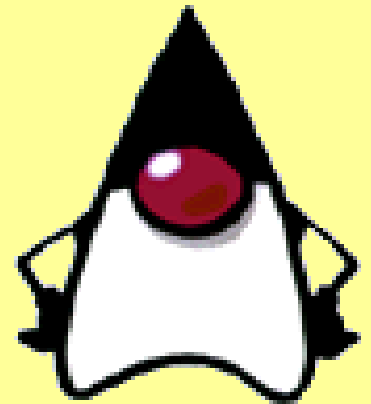
- Before JDK 5
 - ▶ Only integer constants allowed
- JDK 5
 - ▶ + enumeration types
- JDK 7
 - ▶ + strings (string literals)

Strings in switch statement

```
switch (language) {  
    case "cz":  
        value = "Ahoj";           break;  
    case "en":  
        value = "Hi";             break;  
    case "de":  
        value = "Guten tag";     break;  
    default:  
        value = "Hello";         break;  
}
```

JDK 1 - JDK 5

```
int monthNameToDays(String s, int year) {  
    if(s.equals("April") ||  
        s.equals("June") ||  
        s.equals("September") ||  
        s.equals("November"))  
        return 30;  
    if(s.equals("January") ||  
        s.equals("March") ||  
        s.equals("May") ||  
        s.equals("July") ||  
        s.equals("August") ||  
        s.equals("December"))  
        return 31;  
    if(s.equals("February"))  
        ...  
    else  
        ...}  
}
```



JDK 7

```
int monthNameToDays(String s, int year) {  
    switch(s) {  
        case "April":  
        case "June":  
        case "September":  
        case "November":  
            return 30;  
        case "January":  
        case "March":  
        case "May":  
        case "July":  
        case "August":  
        case "December":  
            return 31;  
        case "February":  
            ...  
    }  
}
```

“Diamond” operator



Pre-generics style of Java code

```
List list =  
new ArrayList();
```

JDK 5 with generics support

```
List<String> list =  
new ArrayList<String>;
```


JDK 7 and “diamond” support

```
List<String> list =  
    new ArrayList<>();
```

JDK 7 and “diamond” support

```
List<List<List<List<String>>>> list =  
    new ArrayList<>();
```

“Diamond” operator

```
Map<String, Collection<Integer>>  
map = new LinkedHashMap<String,  
    Collection<Integer>>();
```



```
Map<String, Collection<Integer>>  
map = new LinkedHashMap<>();
```

Automatic Resource Management (ARM)

```
FileOutputStream fos = new FileOutputStream(file);  
InputStream is = url.openStream();
```

```
byte[] buf = new byte[2048];  
int len;  
while ((len = is.read(buf)) > 0) {  
    fos.write(buf, 0, len);  
}
```

Incorrect solution

```
public void write(URL url, File file)
{
    try {
        FileOutputStream fos = new FileOutputStream(file);
        InputStream is = url.openStream();

        byte[] buf = new byte[2048];
        int len;
        while ((len = is.read(buf)) > 0) {
            fos.write(buf, 0, len);
        }
        is.close();
        fos.close();
    }
    catch (IOException e) {}
}
```

Incorrect solution

```
public void write(URL url, File file)
{
    try {
        FileOutputStream fos = new FileOutputStream(file);
        InputStream is = url.openStream();

        byte[] buf = new byte[2048];
        int len;
        while ((len = is.read(buf)) > 0) {
            fos.write(buf, 0, len);
        }
        is.close();
        fos.close();
    }
    catch (IOException e) {}
}
```

The diagram illustrates the exception handling in the provided code. A yellow box labeled "FileNotFoundException" has an arrow pointing to the line `FileOutputStream fos = new FileOutputStream(file);`. Another yellow box labeled "IOException" has two arrows: one pointing to the line `is.close();` and another pointing to the line `fos.close();`.

Correct solution

- Implemented using more nested try-catch-finally blocks
- `is.close()` and `fos.close()` can throw exception
 - ▶ **And they are in finally blocks!**
- Solution is more than 3 slides long :-)
- Exception from close methods should propagate

Automatic Resource Management (ARM)

```
public void write(URL url, File file) throws IOException
{
    try (
        FileOutputStream fos = new FileOutputStream(file);
        InputStream is = url.openStream() )
    {
        byte[] buf = new byte[2048];
        int len;
        while ((len = is.read(buf)) > 0) {
            fos.write(buf, 0, len);
        }
    }
}
```


Automatic Resource Management (ARM)

- After the previous method finishes:
 - ▶ `FileInputStream` is automatically closed
 - ▶ `InputStream` is automatically closed
 - ▶ all system resources are released
 - ▶ ... and (almost) nothing can be forgotten
- New interface `java.lang.AutoCloseable`

Better form of exception handling

- Earlier:

```
try {  
    ...program block...  
} catch (FirstException ex) {  
    logger.error(ex);  
    throw ex;  
} catch (SecondException ex) {  
    logger.error(ex);  
    throw ex;  
}
```

Better form of exception handling

- In OpenJDK7:

```
try {  
    ...program block...  
} catch (FirstException |  
        SecondException ex) {  
    logger.error(ex);  
    throw ex;  
}
```

More information in backtrace

```
java.io.IOException
  at Suppress.write(Suppress.java:19)
  at Suppress.main(Suppress.java:8)
  Suppressed: java.io.IOException
    at Suppress.close(Suppress.java:24)
    at Suppress.main(Suppress.java:9)
  Suppressed: java.io.IOException
    at Suppress.close(Suppress.java:24)
    at Suppress.main(Suppress.java:9)
```

java.lang.AutoCloseable



java.lang.AutoCloseable

- Interface with a single method signature
 - ▶ `close()`
- For objects which have to be “closed” when not needed
- This method is called automatically from an extended `try` statement
 - ▶ See previous slides
- Also available for JDBC 4.1!
 - ▶ `java.sql.Connection`
 - ▶ `java.sql.ResultSet`
 - ▶ `java.sql.Statement`

java.lang.AutoCloseable (1)

AbstractInterruptibleChannel, AbstractSelectableChannel, AbstractSelector, AsynchronousDatagramChannel, AsynchronousFileChannel, AsynchronousServerSocketChannel, AsynchronousSocketChannel, AudioInputStream, BufferedInputStream, BufferedOutputStream, BufferedReader, BufferedWriter, ByteArrayInputStream, ByteArrayOutputStream, CharArrayReader, CharArrayWriter, CheckedInputStream, CheckedOutputStream, CipherInputStream, CipherOutputStream, DatagramChannel, DatagramSocket, DataInputStream, DataOutputStream, DeflaterInputStream, DeflaterOutputStream, DigestInputStream, DigestOutputStream, FileCacheImageInputStream, FileCacheImageOutputStream, FileChannel, FileImageInputStream, FileImageOutputStream, FileInputStream, FileLock, FileOutputStream, FileReader, FileSystem, FileWriter, FilterInputStream, FilterOutputStream, FilterReader, FilterWriter, Formatter, ForwardingJavaFileManager...

java.lang.AutoCloseable (2)

GZIPInputStream, GZIPOutputStream, ImageInputStreamImpl, ImageOutputStreamImpl, InflaterInputStream, InflaterOutputStream, InputStream, InputStream, InputStream, InputStreamReader, JarFile, JarInputStream, JarOutputStream, LineNumberInputStream, LineNumberReader, LogStream, MemoryCacheImageInputStream, MemoryCacheImageOutputStream, MLet, MulticastSocket, ObjectInputStream, ObjectOutputStream, OutputStream, OutputStream, OutputStream, OutputStreamWriter, Pipe.SinkChannel, Pipe.SourceChannel, PipedInputStream, PipedOutputStream, PipedReader, PipedWriter, PrintStream, PrintWriter, PrivateMLet, ProgressMonitorInputStream, PushbackInputStream, PushbackReader, RandomAccessFile, Reader, RMICConnectionImpl, RMICConnectionImpl_Stub, RMIConnector, RMIIOPServerImpl, RMIJRMPServerImpl, RMIServerImpl, Scanner, SecureDirectoryStream, SelectableChannel, Selector, SequenceInputStream, ServerSocket, ServerSocketChannel, Socket, SocketChannel, SSLServerSocket, SSLSocket

java.lang.AutoCloseable (3)

StringBufferInputStream, StringReader, StringWriter, URLClassLoader,
WatchService, Writer, XMLDecoder, XMLEncoder, ZipFile,
ZipInputStream, ZipOutputStream

Project Coin

- What did **not** make it into JDK7
 - ▶ Collection declaration
 - ▶ Access to collection items using brackets
 - ▶ Extended annotation options (for methods, parameters...)

:- (

Collection declarations - Lists

```
List<Integer> numbers = [ 1, 2, 4,  
                        8, 16, 32, 64, 128 ];
```

Collection declarations - Sets

```
Set<Integer> numbers = { 256, 512,  
                        1024, 2048, 4096 };
```

Collection declarations - Maps

```
Map<String, String> translations = {  
    "Hi"           : "Bonjour",  
    "Goodbye"     : "Au revoir",  
    "Thanks"      : "Merci"  
};
```

Collections and brackets

```
List<String> list = ...;  
Map<String, String> map = ...;  
  
String firstValue = list[0];  
map["Test"] = firstValue;  
String valueFromMap = map["Test"];
```

Extended annotation options

Current use:

```
@Override  
int overriddenMethod() {}
```

New options:

```
// List of non-null strings  
List<@NonNull String> stringList;
```

Extended annotation options

```
// Non-empty list of strings
@NotEmpty List<String> stringList;

// Non-empty list of non-null strings
@NotEmpty List<@NotNull String> stringList;

// Method with a read-only parameter which
// cannot change its object's attribute(s)
void marshall(@ReadOnly Object arg)
@ReadOnly
```


GNU FDL

Copyright (c) 2011 Pavel Tišnovský

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

Useful links

<http://openjdk.java.net/projects/jdk7/features/>

<http://blogs.sun.com/darcy>

<http://blogs.sun.com/mcimadamore>

<http://www.baptiste-wicht.com/2010/04/java-7-more-dyr>

<http://www.baptiste-wicht.com/2010/04/java-7-updates-1>

<http://gee.cs.oswego.edu/dl/concurrency-interest/index.html>

<http://gee.cs.oswego.edu/dl/jsr166/dist/jsr166ydocs/>

GNU Free Documentation License

<p>GNU Free Documentation License Version 1.2, November 2002</p> <p>Copyright (C) 2000,2001,2002 Free Software Foundation, Inc. 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.</p> <p>B. PREAMBLE</p> <p>The purpose of this license is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondly, this license preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.</p> <p>This license is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.</p> <p>We have designed this license in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this license is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this license principally for works whose purpose is instruction or reference.</p>	<p>Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.</p> <p>The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this license requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.</p> <p>A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.</p> <p>The Document may include Warranty Disclaimers next to the notice which states that this license applies to the Document. These Warranty Disclaimers are considered to be included by reference in this license, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this license.</p>	<p>4. MODIFICATIONS</p> <p>You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:</p> <ol style="list-style-type: none">Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.State on the Title Page the name of the publisher of the Modified Version, as the publisher.Preserve all the copyright notices of the Document.Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.Include an unaltered copy of this license.Preserve the section Entitled "History". Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions if it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.Preserve any Warranty Disclaimers.	<p>5. COMBINING DOCUMENTS</p> <p>You may combine the Document with other documents released under this license, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.</p> <p>The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.</p> <p>In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".</p> <p>6. COLLECTIONS OF DOCUMENTS</p> <p>You may make a collection consisting of the Document and other documents released under this license, and replace the individual copies of this license in the various documents with a single copy that is included in the collection, provided that you follow the rules of this license for verbatim copying of each of the documents in all other respects.</p> <p>You may extract a single document from such a collection, and distribute it individually under this license, provided you insert a copy of this license into the extracted document, and follow this license in all other respects regarding verbatim copying of that document.</p> <p>7. AGGREGATION WITH INDEPENDENT WORKS</p> <p>A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this license does not apply to the other works in the aggregate which are not themselves derivative works of the Document.</p> <p>If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.</p> <p>8. TRANSLATION</p> <p>Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this license, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this license and the original versions of these notices and disclaimers. In case of a disagreement between the translation and the original version of this license or a notice or disclaimer, the original version will prevail.</p> <p>If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.</p> <p>9. TERMINATION</p> <p>You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this license. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this license. However, parties who have received copies, or rights, from you under this license will not have their licenses terminated so long as such parties remain in full compliance.</p>
<p>1. APPLICABILITY AND DEFINITIONS</p> <p>This license applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this license. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.</p> <p>A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.</p> <p>A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.</p> <p>The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this license. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.</p> <p>The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this license. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.</p> <p>A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwarily with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".</p>	<p>2. VERBATIM COPYING</p> <p>You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this license, the copyright notices, and the license notice saying this license applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this license. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.</p> <p>You may also lend copies, under the same conditions stated above, and you may publicly display copies.</p> <p>3. COPYING IN QUANTITY</p> <p>If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.</p> <p>If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.</p> <p>If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.</p> <p>It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.</p>	<p>4. MODIFICATIONS</p> <p>You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:</p> <ol style="list-style-type: none">Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.State on the Title Page the name of the publisher of the Modified Version, as the publisher.Preserve all the copyright notices of the Document.Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.Include an unaltered copy of this license.Preserve the section Entitled "History". Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions if it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.Preserve any Warranty Disclaimers. <p>If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.</p> <p>You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.</p> <p>You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by anyone else, you may not add another; but you may replace the old one, an explicit permission from the previous publisher that added the old one.</p> <p>The author(s) and publisher(s) of the Document do not by this license give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.</p>	<p>5. COMBINING DOCUMENTS</p> <p>You may combine the Document with other documents released under this license, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.</p> <p>The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.</p> <p>In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".</p> <p>6. COLLECTIONS OF DOCUMENTS</p> <p>You may make a collection consisting of the Document and other documents released under this license, and replace the individual copies of this license in the various documents with a single copy that is included in the collection, provided that you follow the rules of this license for verbatim copying of each of the documents in all other respects.</p> <p>You may extract a single document from such a collection, and distribute it individually under this license, provided you insert a copy of this license into the extracted document, and follow this license in all other respects regarding verbatim copying of that document.</p> <p>7. AGGREGATION WITH INDEPENDENT WORKS</p> <p>A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this license does not apply to the other works in the aggregate which are not themselves derivative works of the Document.</p> <p>If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.</p> <p>8. TRANSLATION</p> <p>Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this license, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this license and the original versions of these notices and disclaimers. In case of a disagreement between the translation and the original version of this license or a notice or disclaimer, the original version will prevail.</p> <p>If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.</p> <p>9. TERMINATION</p> <p>You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this license. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this license. However, parties who have received copies, or rights, from you under this license will not have their licenses terminated so long as such parties remain in full compliance.</p>

Thank you for your attention

