JSR 294 and Transparency

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Bio

Spec lead, Java Language and VM (901, 924)

Spec lead, Improved Modularity Support in the Java Language (294)

Co-spec lead, Annotations on Java Types (308)

Maintenance lead, JSRs 14 / 175 / 201 / 202

Spec lead, OpenJDK Project Lambda

Occasional observer, OSGi Alliance CPEG

Academic liaison (ECOOP, OOPSLA)

Multiple slots at JavaOne and Devoxx every year

Disclaimer

My JCP experience is with core Java SE JSRs only

Remember "Quality / Scope / Cost / Time"

Global impact (Quality)

Infinite supply of opinions, infinite demand for "more" (Scope)

Finite supply of resources (Cost)

Relationships with other bodies e.g. Java EE, OSGi, OpenJDK (Time)

My comments may not apply to SE/EE JSRs further up the stack

The Java modularity landscape

JSR 294

- Language and VM features to support module systems
- Expert Group includes Sun, IBM, Oracle, Google, P.Kriens, D.Lea

Jigsaw

- A module system for JDK7
- Not part of a JSR
- May use language and VM features from JSR 294

OpenJDK *Project Jigsaw*

- Hosts the Reference Implementation of JSR 294
- Hosts the design and implementation of the Jigsaw module system
- Hosts discussion on JDK modularization

Module-private accessibility

When a package exposes “too many” public types, other packages are liable to depend on them

To share types and members *across packages but within a module,* make them *module-private*:

```
module class Foo {
  module String m() { … }
}
```

Any class in the same module as Foo can access Foo and Foo.m

- Module-private accessibility stored in Foo.class and enforced by the JVM
- In the 294 RI, module membership is inferred from filesystem layout

`module` is a “restricted keyword”

Adding keywords that break code is frowned upon

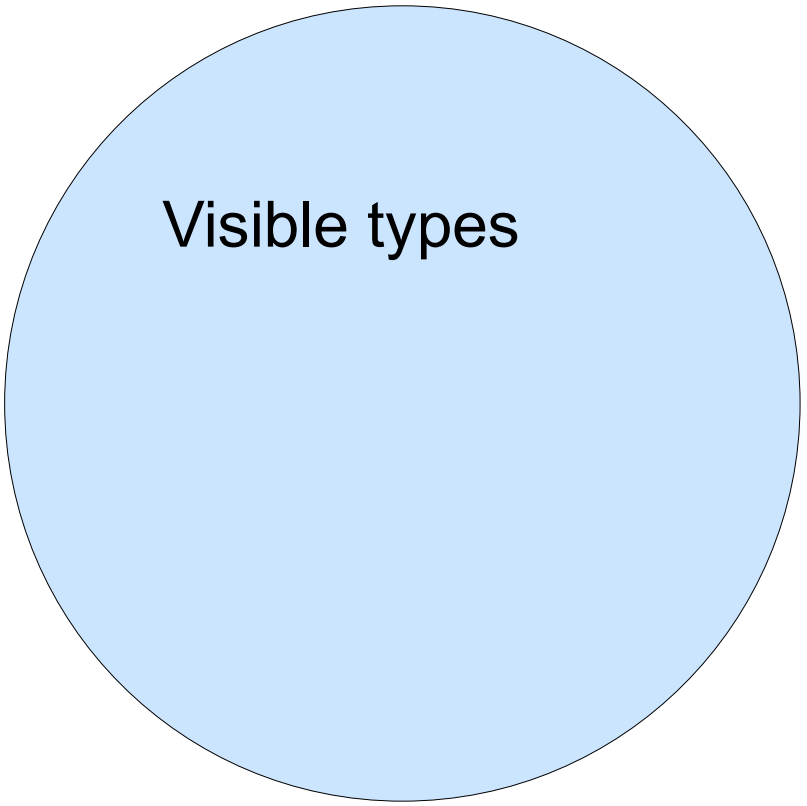
You really can write:

```
package module;
module class module {
   module module module = new module();
   module module() {}
}
```

(can != should)

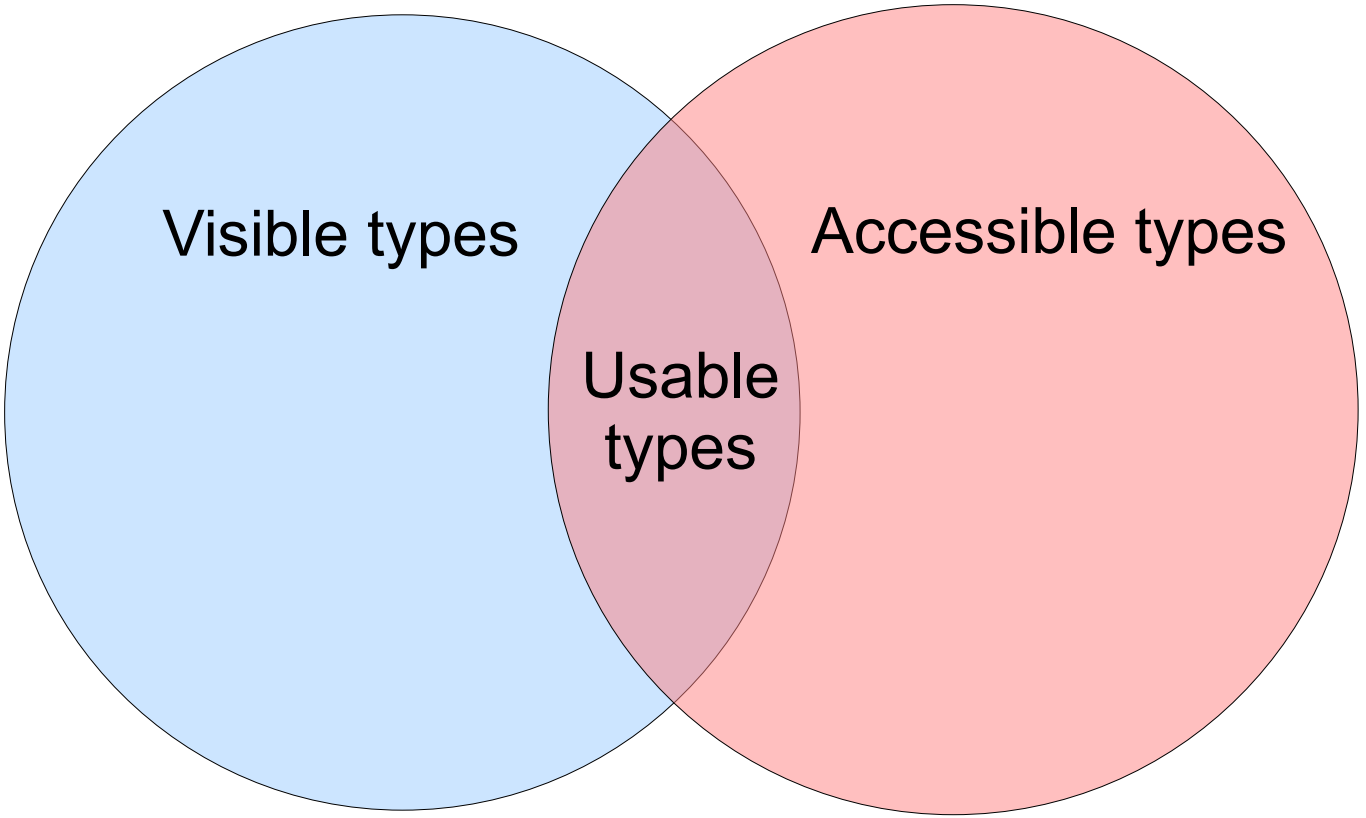
How does this help a module system?

Visibility & Accessibility



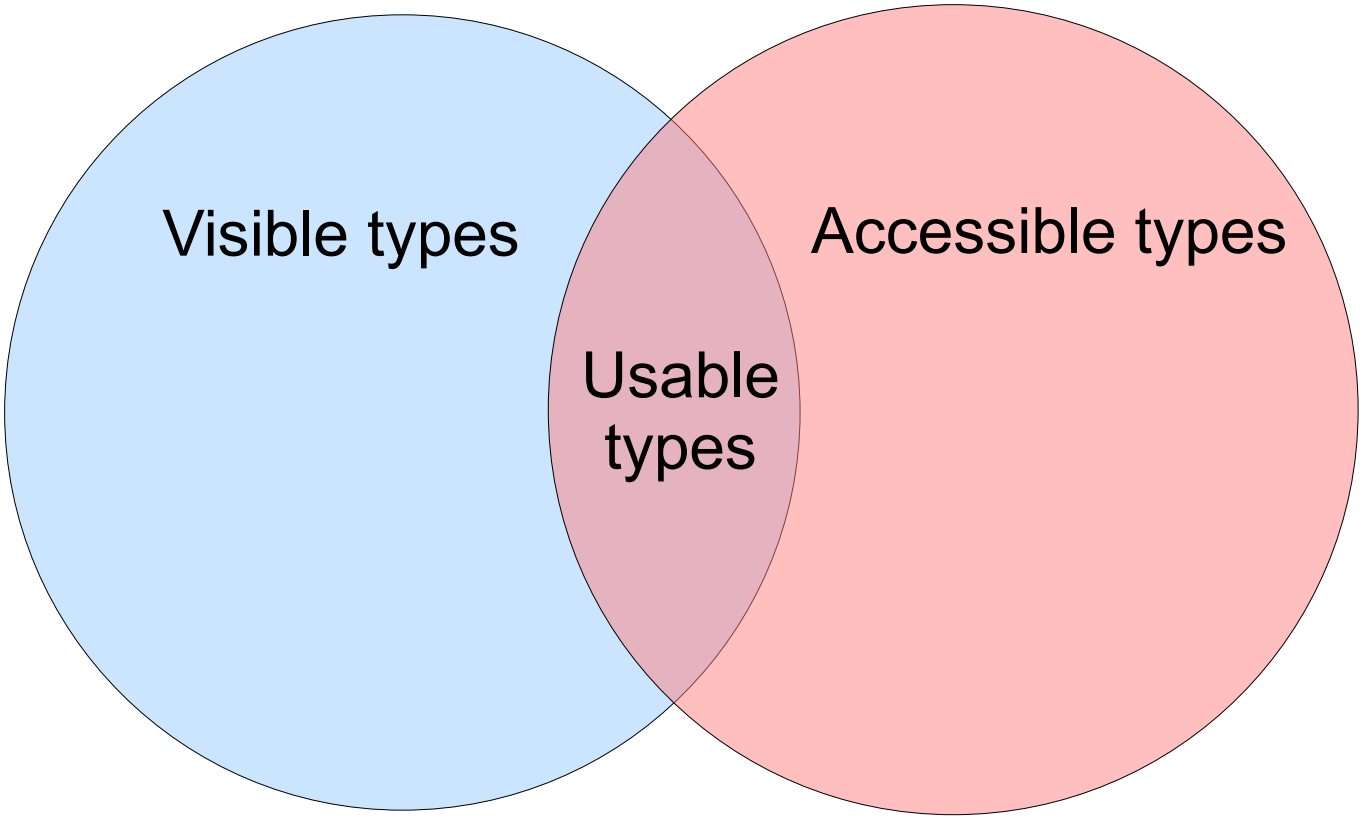
Visibility determines whether one type can **see** another type
"Observability" in the JLS → sourcepath+classpath in the RI (javac)
Class loading in the JVMS → classpath in the RI (application class loader)

Visibility & Accessibility



Accessibility determines whether a visible type can be **used**
public/protected/package/private in the JLS and JVMS
For a type to be accessible, it must first be visible

Visibility & Accessibility



Module systems on the JVM govern visibility via class loaders
But if the underlying types are public, access is permitted
JSR 294 allows a module system to govern accessibility too

Module-private accessibility

Runtime module: an object whose class implements RuntimeModule

```
public interface java.lang.module.RuntimeModule {
  boolean hasModuleAccess(java.lang.module.RuntimeModule other);
}
```

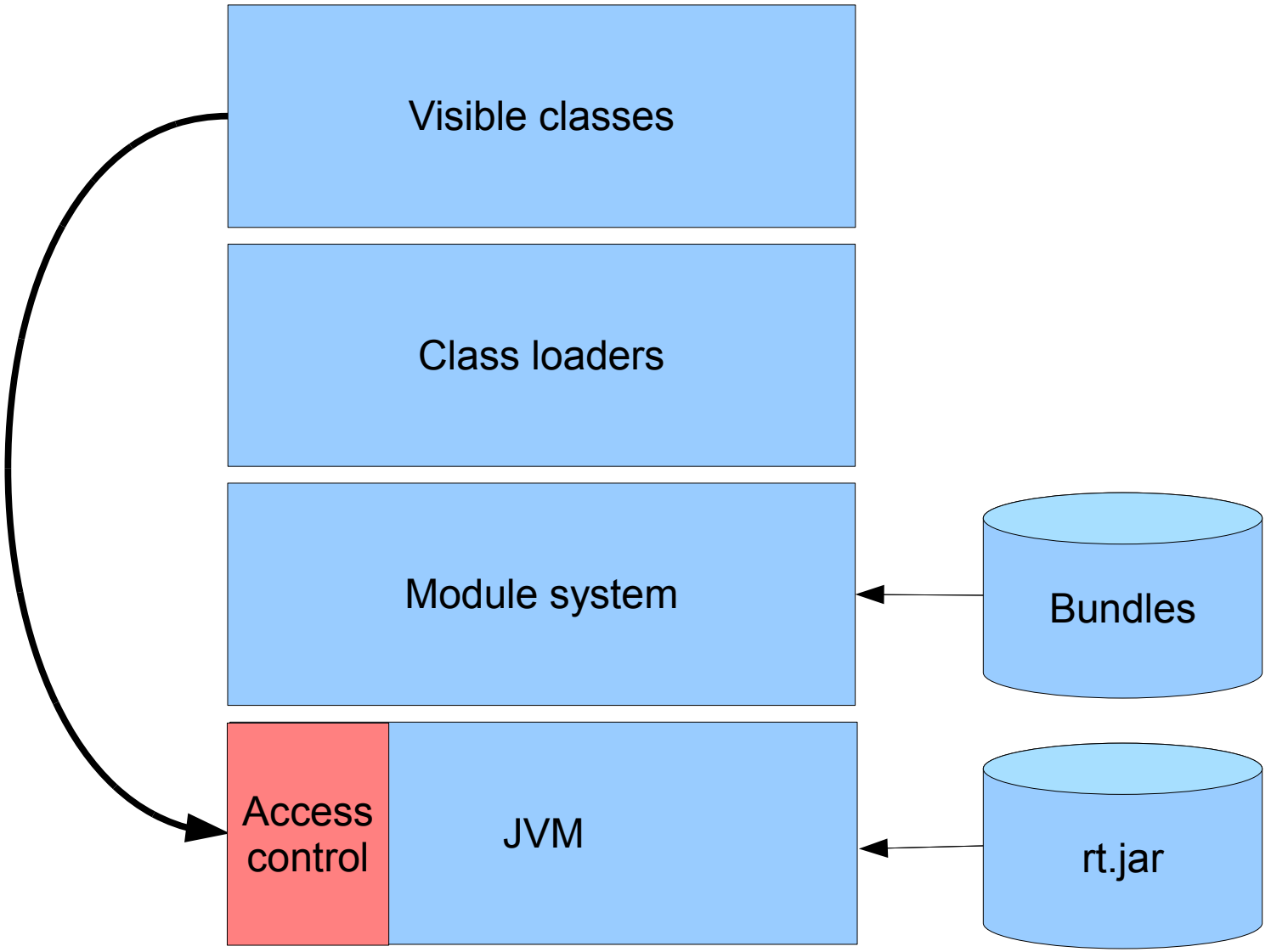
A module system generates runtime modules to tag classes

```
public abstract class java.lang.ClassLoader {
  protected final Class<?> defineClass(String name, byte[] b,
    int off, int len, ProtectionDomain protectionDomain,
    java.lang.module.RuntimeModule m);
}
```

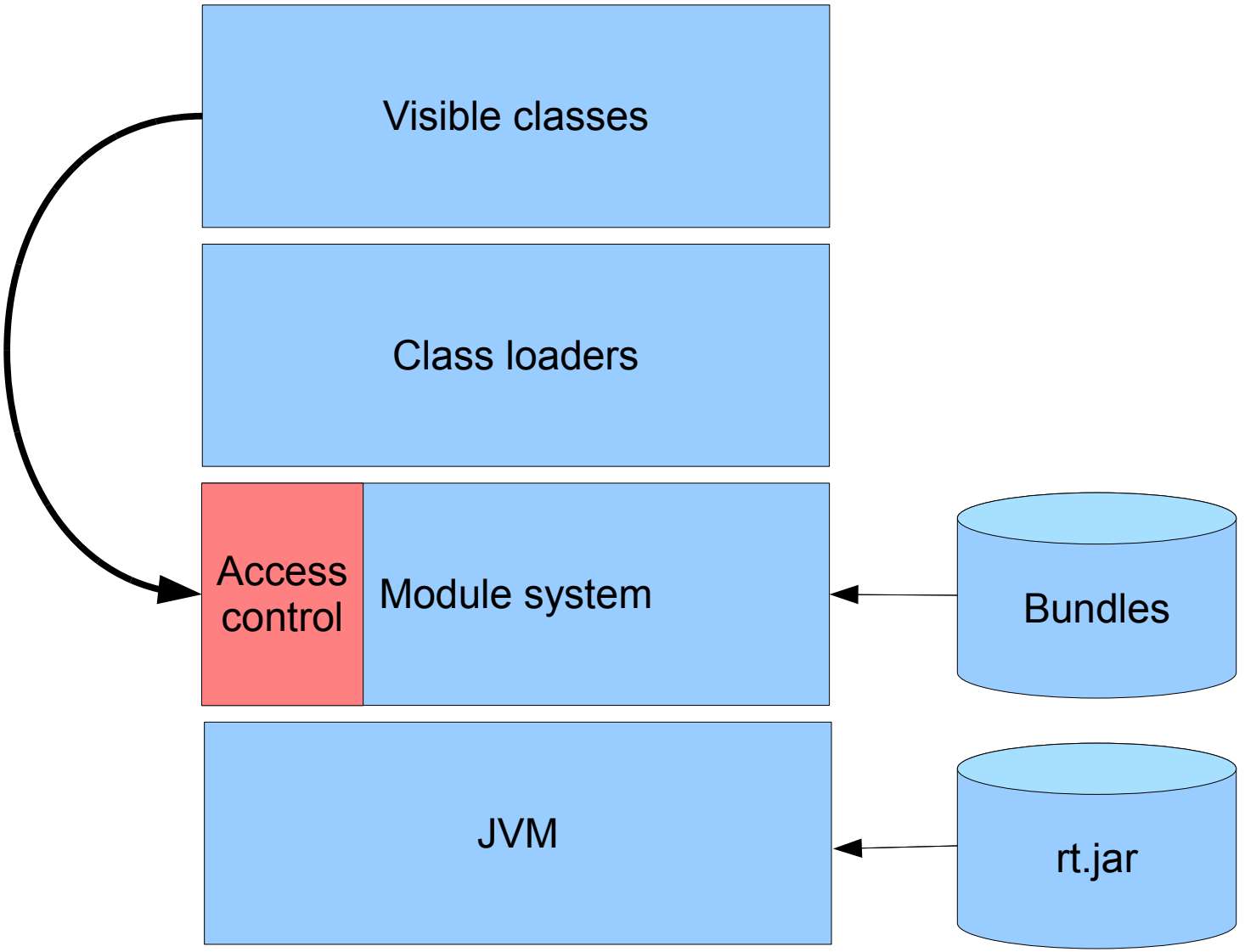
The JVM allows access to a module-private type/member iff

- the accessing class has the same runtime module, or
- the runtime module of the accessed class permits access

Today


Visible classes
Class loaders
Module system
Bundles
Access control
JVM
rt.jar

With JSR 294, it is *as if* ...



Specification v. Implementation

JSR 292 standardizes linkage protocols, not linkage behavior

JSR 294 standardizes module accessibility, not module boundaries

In OSGi, classes in a bundle usually have the same runtime module

- But classes in different bundles can have the same runtime module
- And classes in a bundle can have different runtime modules

The RI (javac+Hotspot) puts classes in modules based on *modulepath*

- Like *classpath*, but with an additional top level for modules
- May also consult Jigsaw to search libraries and resolve dependencies

Modularizing the JDK

Concern about the JDK relates to its size, not its encapsulation

Jigsaw offers various mechanisms to compatibly split up the JDK

- Statically resolvable dependencies
- Local dependencies (safe split packages)
- Granular optional dependencies
- Reverse dependencies
- Virtual modules
- Multi-dimensional versions

These mechanisms are entirely about better visibility control

Module-private accessibility is a second-tier technique for JDK code

Best practices for transparency

What 294 does

- “The public should know who is on the EG”
- “Publicly readable alias on which EG business is reported”
- “JSR schedule should be published and regularly updated”
- “Publicly readable discussion forum or Wiki”
- “Publicly writable alias for feedback or comments”
- “Spec leads should speak at conferences and events”
- “Open-source development processes for the RI and TCK are encouraged...”
- “Community Update page should point to all other public communications”

What 294 does not do

- “Public issue-tracking (spec issues, RI/TCK bugs)”

Mailing lists (Adopted by 292 + 330)

Private EG list

- jsr-294-eg@jcp.org (the traditional JCP EG list)

Normal EG list

- jsr294-modularity-eg@cs.oswego.edu
- Only EG members can read and write
- There is one special member: the Observer list

Observer list

- jsr294-modularity-observer@cs.oswego.edu
- Anyone can subscribe, read, and write the observer list
- Receives all traffic from the normal EG list
- EG members are not on the observer list (unless they choose to be)

The Observer list

158 non-digest + 46 digest members (1/11/10)

Subscriptions must be approved, but no moderation

IP flow is controlled (welcome mail has a JSPA-like license)

Gives a voice to members of the public

- Comment on EG discussions, sometimes receiving EG member feedback
- Make novel suggestions that other observers may help work through

Helps people at EG member companies to track activity

It's hard to imagine how the JSR could be more open

- EG primacy is not questioned because most content comes from the EG list
- The EG still has a private place to meet, but hardly ever needs it

Challenges in transparency

The science – visibility v. accessibility – is hardly understood

The engineering has many moving parts (lang, VM, libs, tools...)

The clients – OSGi and Jigsaw – are complex communities

Official mailing lists don't get the message across

- Casual observers see too much detail, not enough vision
- Keen observers read unofficial and uninformed sources too

Most Java developers don't care about principled platform extensions

- Would rather have easier expression than stronger rules
- → Closures has 100x the interest of modularity

Personal suggestions

Mandate a formal scoping exercise before a JSR is formed

- Little EG agreement on scope for most of 294's life
- Sun rolled its own questionnaire for OpenJDK *Project Coin*

Mandate publicly readable and writable observer lists

Provide a PR framework for engaging casual observers

- Early Draft Reviews are too detailed
- What the EG isn't doing is as important as what it is doing
- http://java7.tumblr.com/search/294

Thank you

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