1 Java 8 – 11 Features

1.1 Lambdas, Streams

Cycles Simplification

How to do it simpler?

```
List<LocalDate> myReports = new ArrayList<>();
for (Report r : reports) {
   if (r.isActive()) {
      if (r.getAuthor().equals(me)) {
         myReports.add(r.getDueTo());
      }
   }
}
Collections.sort(myReports);
```

Nothing wrong, business as usual. Can we do it better?

Cycles Simplification

Is this better/more readable?

```
List<LocalDate> myReports = reports.stream()
   .filter((Report r) -> r.isActive())
   .filter((Report r) -> r.getAuthor().equals(me))
   .map((Report r) -> r.getDueTo())
   .sorted()
   .collect(Collectors.toList());
```

...and we can continue...

Cycles Simplification

We can remove types...

```
List<LocalDate> myReports = reports.stream()
      .filter(r -> r.isActive())
      .filter(r -> r.getAuthor().equals(me))
      .map(r -> r.getDueTo())
      .sorted()
      .collect(Collectors.toList());
```

...and we can continue...

Cycles Simplification

We can use method reference...

```
   public static boolean isMyReport(Report r) {
      return r.equals(me);
   }

List<LocalDate> myReports = reports.stream()
      .filter(Report::isActive)
      .filter(TestFunctional::isMyReport)
      .map(Report::getDueTo)
      .sorted()
      .collect(Collectors.toList());
```

...Let's compare it on the next slide!

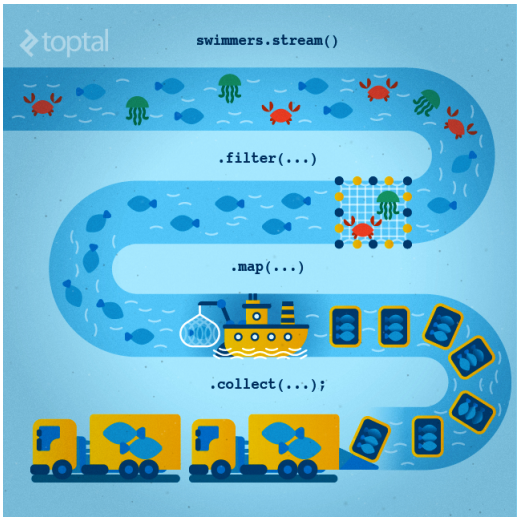


Figure 1: Stream processing visualization. Source: https://www.toptal.com/java/why-you-need-to-upgrade-to-java-8-already

Cycles Simplification

Before

```
List<LocalDate> myReports = new ArrayList<>();
for (Report r : reports) {
   if (r.isActive()) {
      if (r.getAuthor().equals(me)) {
         myReports.add(r.getDueTo());
} } }
Collections.sort(myReports);
```

After

```
List<LocalDate> myReports = reports.stream()
      .filter(Report::isActive)
      .filter(TestFunctional::isMyReport)
      .map(Report::getDueTo)
      .sorted()
      .collect(Collectors.toList());
```

Stream

Lambda for Multithreaded Application

So far it was just a syntax suger. BUT! How easily can you write multithreaded apps?

```
List<LocalDate> myReports = reports.stream()
      .parallel(); // run on multiple threads!
      .filter(RemoteVerification::isValid) // calls outsite service
      .collect(Collectors.toList());
```

1.2 Optional

Optional

Before

```
Report r = reports.get(0);
Band header = r.getHeaderBand();
if(header!=null) {
   title = header.getTitle();
   if(title==null) {
      title = "Default Title";
   }
}
```

After

```
String title = Optional.of(reports.get(0))
      .map(Report::getHeaderBand)
      .map(Band::getTitle)
      .orElse("Default Title");
```

Log4j

Before – annoying

```
if(log.isDebugEnabled()) {
   log.debug(prepareDataForLog());
}
```

Simple – useless overhead if not used

```
log.debug(prepareDataForLog());
```

Functional – simple and effective

```
log.debug(() -> prepareDataForLog());
```

2 Agile World

Waterfall, Model V

- What's wrong with waterfall, model V (e.g. detailed planning before programming)? Everything!
  - Detailed analysis becomes useless immediately after programming starts – many assumptions are wrong.
  - Detailed long-time planning is crazy - can you say, what you will do on September 21^{st} 2019 in the morning? And afternoon?
  - Users tend to change their minds when they see the first version.

  - Programming takes long time and situation changes.
  - Studies have shown that in over 80 % of the investigated and failed software projects, the usage of the Waterfall methodology was one of the key factors of failure.

Agile Style of Work

- Principles (see agilemanifesto.org)
  - Individuals and interactions over processes and tools
  - Working software over comprehensive documentation
  - Customer collaboration over contract negotiation
  - Responding to change over following a plan
- pair programming
- SCRUM or Canban
- Cooperation is much more important than individual success.
- **Frequent and regular increments!** Often are shared with customers.

2.1 Continuous Integration & Deployment

Continuous Integration

- After every commit, build is verified – including unit tests
- At least once a day, the whole product is deployed – including functional tests
- UI tests are done frequently (can take hours)
- . . . all automated.
- Quick detection of errors, cheaper fixes, fewer integration issues.

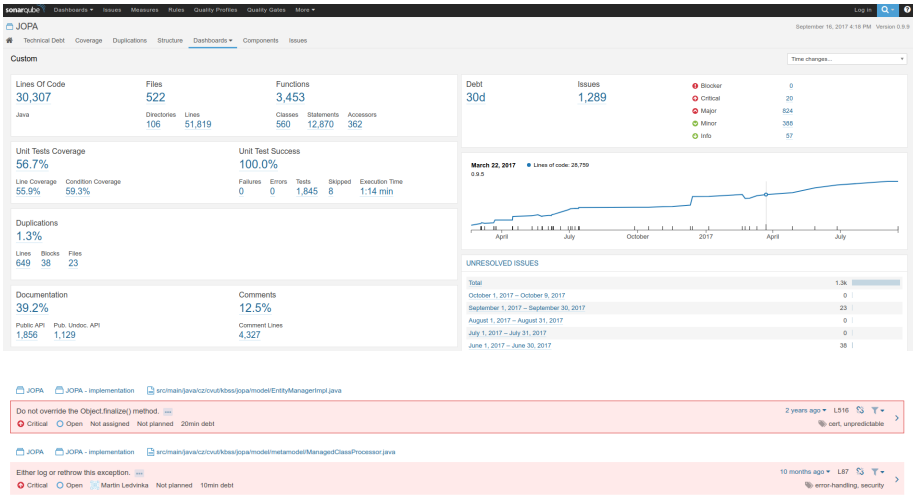
CI Tools

Version Control

- **Git**, others: CSV, Subversion, Bazaar, Mercurial, Bitkeeper, RTC. . .

CI Servers

- **Jenkins**
  - Open-source, easy to setup,
  - Highly configurable, lots of plugins.

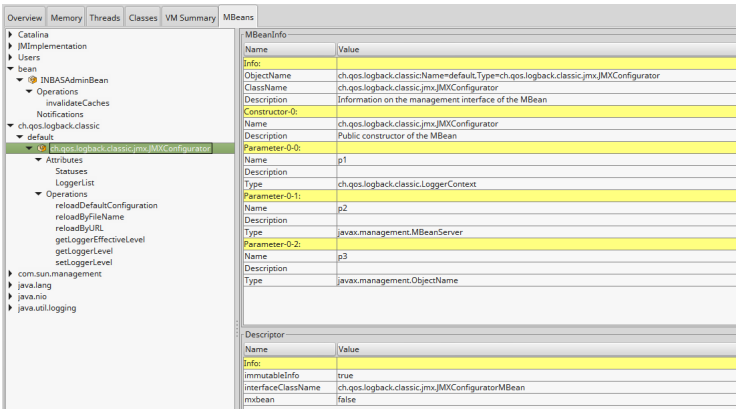


- **TeamCity**
  - Free for 3 agents and 20 build configurations,
  - Developed by JetBrains,
  - More suitable for enterprises – beast.
- **Gitlab CI**
- Today's servers concentrate on whole process including deployment to cloud.

Static Code Analysis

- Analyze code structure or flows, don't run it.
- Full-featured IDEs contain some sort of SCA.
- **Checkstyle** – checks just formatting.
- **FindBugs** – simple and pretty fast check, can find adding to String inside cycle, impossible equals, bad null handling...
- **Sonarqube** – server-side analysis, long, discovers data flow from database to servlet (e.g. finds XSS)

Sonarqube



3 Application Monitoring and Administration

3.1 JMX

Java Management Extensions (JMX)

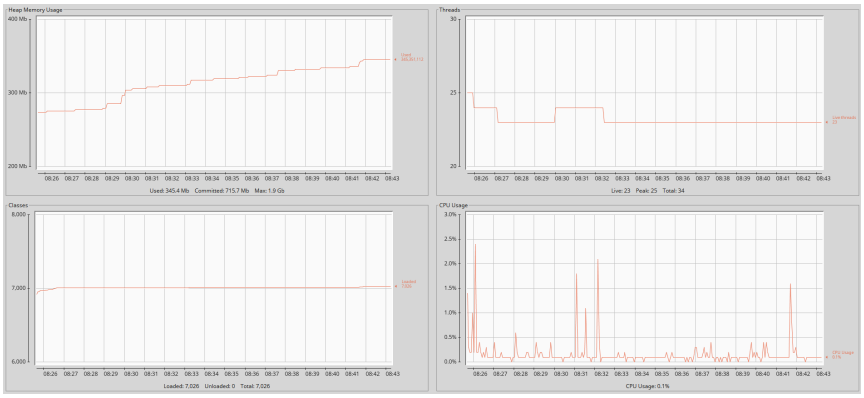
- Allow management of resources in an application,
- Standard part of the Java platform,
- Resources represented by *Managed Beans* (*MBeans*), registered in an *MBean* server,
- Accessible via JMX connectors.

Managed Beans

- Operations (MBean methods), through which the application can be managed,
- Attributes (getters/setters) for information/configuration.

Application Management via JMX

- Connect to application with *JConsole*,
- Locate the desired MBean,
  - Invoke managed operations,
  - View/configure attributes,
- MBean server set up in Spring – `@EnableMBeanExport`.



3.2 Monitoring Tools

JConsole – LIVE DEMO

- GUI-based Java monitoring tool,
- JMX compliant,
- Allows connection to local or remote (if configured) processes,
- Part of the JDK.

VisualVM

- GUI-based Java monitoring tool, works also on IBM Java on mainframes
- Allows collection and saving of monitoring data,
  - Thread dump, heap dump,
- Profiling, sampling,
  - CPU, memory,
  - Local applications only,
  - Profiling has major impact on application performance,
- Support for plugins,
- Analysis of stored thread or heap dumps.

More Tools

JDK

- **jmap** – memory-related statistics about a VM, obsolete,
- **jcmd** – send diagnostic commands to JVM, internally used by the GUI tools,
- **jstat** – monitors JVM statistics, lots of options.

- **Eclipse MAT** – advanced memory analyzer,
- **Java Mission Control** and **Java Flight Recorder** – commercial JVM monitoring tools by Oracle,
- **StageMonitor**, **MoSKito** etc. – open source alternatives.
- **CA Wily** – very famous and very detailed monitoring of JavaEE

JavaMelody

- Very simple to implement (few lines in web.xml, few lines in pom.xml)
- Navigate to `/monitoring` and enjoy!
- LIVE DEMO (at least PDF)
  - Records data for last year, older data is sumarized, old data removed
  - memory, sessions, threads, CPU, disk space, network bandwidth, SQL traffic, JMX, timing statistics of requests...
  - actions: invalidate sessions, perform garbage collection, memory dump

4 Database Versioning

Database Versioning

- JPA provides a possibility to create missing tables
- ... useless when table is changed
- Libraries: **Liquibase** and **Flyway**
- A list of changes is recorded, keeps current database version
- Application keeps steps to upgrade from one version to the next
- The most reliable way
- Alternatives: direct upgrades from older version (leads to multiple ways – hard testing), creating SQL scripts (customers tend to make mistakes during deployment, problematic error handling)

5 Production

Production Environments

- As usual – supported servers inside client's network (Payara, Glassfish, TomEE, WildFly, WebSphere)
- Hosted – our servers in server houses
- Currently investigating – Clouds, Docker
  - Problem with acceptance in banks
  - Cloud requires multitenancy application, e.g. there is a big risk of information leak, very rare
  - Docker seem a good choice, pack of all required software, needs just CPU, memory, disk space, TCP/IP ports.

What We Actually Use

- Versioning: git, gitlab
- CI: Jenkins, investigating Gitlab CI
- Code analyzis: Findbugs
- IDE: NetBeans :-) (In fact, this doesn't matter.)
- Servers: Payara, TomEE, less Glassfish, WebSphere, WildFly
- Databases: MSSQL, Oracle, investigating PostgreSQL
- Monitoring: JavaMelody
- OS: our systems – Linux, clients often Windows

The End

Thank You Petr Aubrecht petr.aubrecht@stringdata.cz

Resources

- R. Urma, M. Fusco and A. Mycroft: Java 8 in Action,
- http://www.oracle.com/technetwork/articles/java/ma14-java-se-8-streams-2177646.html,
- https://martinfowler.com/articles/continuousIntegration.html,
- http://docs.oracle.com/javase/tutorial/jmx/mbeans/index.html,
- http://docs.oracle.com/javase/7/docs/technotes/guides/management/jconsole.html,
- https://visualvm.github.io/documentation.html,
- https://github.com/javamelody/javamelody/wiki.