

# 1 Java 8 – 21 Features

## 1.1 Lambdas, Streams

### Cycles Simplification

How to do make 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()
    .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()
    .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()
    .toList();
```

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

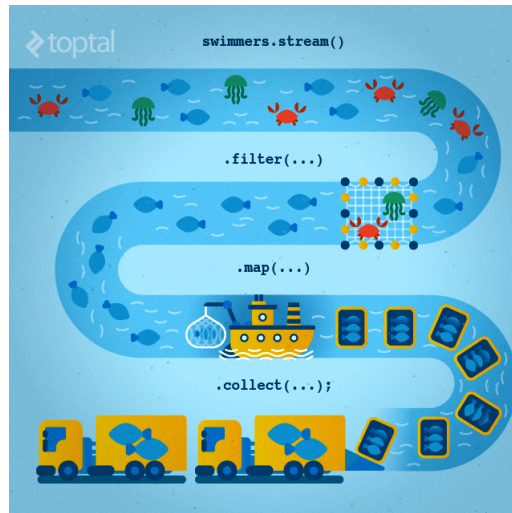


Figure 1: Stream processing visualization. Source: <https://www.toptal.com/java/why-you-need-to-upgrade-to-java-8-already>

## 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()
    .toList();
```

## Stream

### Lambda for Multithreaded Application

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

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

### Couple of Usefulness

#### Switch Expression

```
int value = switch (day) {
    case MONDAY, FRIDAY, SUNDAY -> 6;
    case TUESDAY -> 7;
    case THURSDAY, SATURDAY -> 8;
    case WEDNESDAY -> 9;
    default -> throw new IllegalStateException("Invalid day: " + day);
}
```

### Records aka Lombok

```
record Point(int x, int y) {}
```

## Couple of Usefulness

### Text Blocks

```
public static final String SAMPLE_ENTRY
    = """
    R 6 (#70c710)
    D 5 (#0dc571)
    L 2 (#5713f0)
    """;
```

### Virtual Threads

```
Thread.startVirtualThread(() -> {
    // do asynch job
});
```

### ...and Many Others

- `Collectors.teeing,`
- `String.repeat(n)` or `Stream<String> lines()`
- `if(abj instanceof String str) {}`
- JMH
- `NullPointerException: a.b.c()`
- shebang
- Vector API (Incubator)
- Foreign Function and Memory API (Incubator)

## 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<sup>st</sup> 2021 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. [https://www.scrum-institute.org/What\\_Makes\\_Waterfall\\_Fail\\_in\\_Many\\_Ways.php](https://www.scrum-institute.org/What_Makes_Waterfall_Fail_in_Many_Ways.php)

## **Agile Style of Work**

- Principles (see [agilemanifesto.org](http://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.

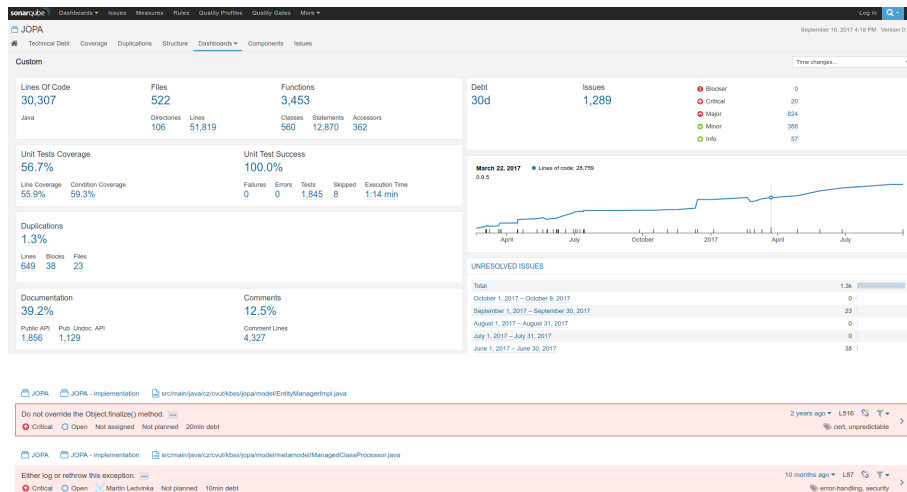
### **CI Tools**

#### **Version Control**

- **Git**, others: CSV, Subversion, Bazaar, Mercurial, Bitkeeper, RTC...
- Pro GIT (Chapter 1 Introduction, Chapter 2 Basics, Chapter 3 Branches)

#### **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.
- **SpotBugs(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

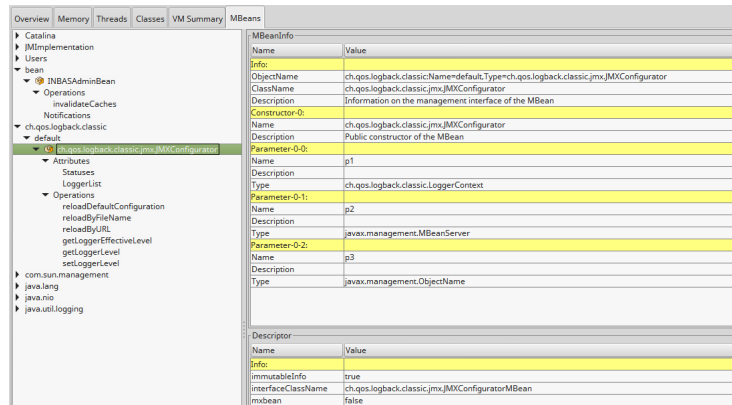
## 2.2 12 Factor App

### 12 Factor App 1/2

- <https://12factor.net/>
- I. Codebase
  - One codebase tracked in revision control, many deploys
- II. Dependencies
  - Explicitly declare and isolate dependencies
- III. Config
  - Store config in the environment
- IV. Backing services
  - Treat backing services as attached resources
- V. Build, release, run
  - Strictly separate build and run stages
- VI. Processes
  - Execute the app as one or more stateless processes

### 12 Factor App 2/2

- VII. Port binding
  - Export services via port binding
- VIII. Concurrency
  - Scale out via the process model
- IX. Disposability
  - Maximize robustness with fast startup and graceful shutdown
- X. Dev/prod parity
  - Keep development, staging, and production as similar as possible
- XI. Logs
  - Treat logs as event streams
- XII. Admin processes
  - Run admin/management tasks as one-off processes



## 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`.



## 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

## 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)
- Example of bad database upgrade: <https://docs.gitlab.com/ee/update/#upgrade-paths>
- Martin Fowler: Evolutionary Database Design

## 5 Production

### Production Environments

- As usual – supported servers inside client’s network (Payara, Glassfish, TomEE, WildFly, WebSphere)
- Hosted – our servers in server houses
- 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, github, gitlab
- CI: Jenkins, investigating Gitlab CI
- Code analyzis: Spotbugs
- IDE: NetBeans :-), Idea (In fact, this doesn’t matter.)
- Servers: Payara, TomEE, less Glassfish, WebSphere, WildFly
- Databases: PostgreSQL, MSSQL, Oracle
- Monitoring: JavaMelody
- OS: our systems – Linux, clients often Windows, recently Docker

### The End

Thank You Petr Aubrecht petr@aubrecht.net

## 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>
- <https://www.martinfowler.com/articles/evodb.html>
- <http://docs.oracle.com/javase/tutorial/jmx/mbeans/index.html>
- <http://docs.oracle.com/javase/7/docs/technotes/guides/management/jconsole.html>
- <https://github.com/javamelody/javamelody/wiki>