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Object Oriented Architectures and Secure Development

Logging II

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Recap: what is logging again?

- Keeping track of errors, status changes, … in your application
- In the most simple form: writing towards a text file
- Various logging frameworks/mechanisms exist
- In our classes: java.util.logging → built-in logging mechanism

Note: do not use System.out.println() for logging purposes!

- System.out.println() is used to create command line (terminal) applications
- Using (or rather: abusing) System.out.println() for logging is a major code smell
- https://rules.sonarsource.com/java/RSPEC-106
- We should use actual loggers!

Creating an instance of java.util.logging.Logger

```
package be.howest.ti.shop;

public class Shop {

    private static final Logger LOGGER = Logger.getLogger(Shop.class.getName());

    …

}
```

Creating an instance of java.util.logging.Logger

```
package be.howest.ti.shop;

public class Shop {

    private static final Logger LOGGER = Logger.getLogger("be.howest.ti.shop.Shop");

    …

}
```

Why we should use java.util.logging.Logger

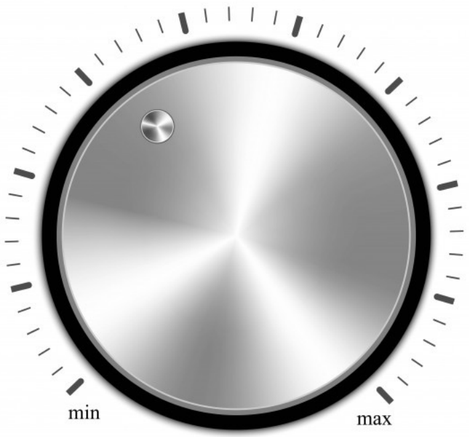
- We decided to use java.util.logging.Logger.
- Other logging frameworks exist, this is just a choice for this course.

- Why static? Because there is no need to keep an instance per object, one suffices.
- Why final? There is no need to change the logger at runtime…
- Why give it the (full)name of the class? This will allow us to configure the log output per class.

- You can pick any name you like, but this is a common practice…

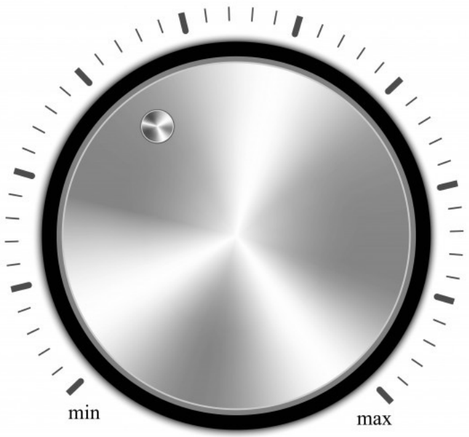
How to use a logger?

- We can use a logger to log a message at a certain level.
- You can configure your logger to change its *“volume level”*.
- The levels are:
  - SEVERE (highest value)
  - WARNING
  - INFO
  - CONFIG
  - FINE
  - FINER
  - FINEST (lowest value)



How to use a logger?

- We can use a logger to log a message at a certain level.
- You can configure your logger to change its “*volume level*”.
- The levels are:
  - SEVERE is a message level indicating a serious failure.
  - WARNING is a message level indicating a potential problem.
  - INFO is a message level for informational messages.
  - CONFIG is a message level for static configuration messages.
  - FINE is a message level providing tracing information.
  - FINER indicates a fairly detailed tracing message.
  - FINEST indicates a highly detailed tracing message.



How to use a logger?

- We can use a logger to log a message at a certain level.
- You can configure your logger to change its volume level.

- *LOGGER*.log(Level.*FINER*, "Product created");
- This exists in many flavours …

Simple Message

```
LOGGER.log(Level.SEVERE, "Simple message");
```

```
Sep 24, 2020 7:47:59 PM be.howest.ti.shop.Program main
SEVERE: Simple message
```

Parameterised Message (built-in)

```
LOGGER.log(Level.SEVERE, "Parameterised message: {0} {1} {2}",
    new Object[]{1, "two", 3}
);
```

Replaces the {x}’s in the message string by the elements in the array.

```
Sep 24, 2020 7:47:59 PM be.howest.ti.shop.Program main
SEVERE: Parameterised message: 1 two 3
```

Delayed Message (with String Supplier)

```
LOGGER.log(Level.SEVERE, () -> String.format("Delayed message: %s", new Date()));
```

If you feel more comfortable with String.format, you should use this form.

Just like with assertThrows, the () -> {} delays the computation until (and if) needed.

```
Sep 24, 2020 7:47:59 PM be.howest.ti.shop.Program main
SEVERE: Delayed message: Thu Sep 24 19:47:59 CEST 2020
```

Exception Message

```
public String toString() {
    try {
        return String.format("Product #%d: %s @ %.2f", this.getCode(),
                this.getName(), this.getPrice());
    } catch (IllegalStateException ex) {
        LOGGER.log(Level.SEVERE, "Unable to determine valid price", ex);
        return String.format("Product #%d: %s", this.getCode(), this.getName());
    }
}
```

Log an exception and its stack trace.

```
sep. 21, 2021 3:08:24 P.M. be.howest.ti.shop.Product toString
SEVERE: Unable to determine valid price
java.lang.IllegalStateException: Product has invalid price
        at be.howest.ti.shop.Product.getPrice(Product.java:32)
        at be.howest.ti.shop.Product.toString(Product.java:50)
```

By default only Severe, Warning and Info are shown.

- We can use a logger to log a message at a certain level.
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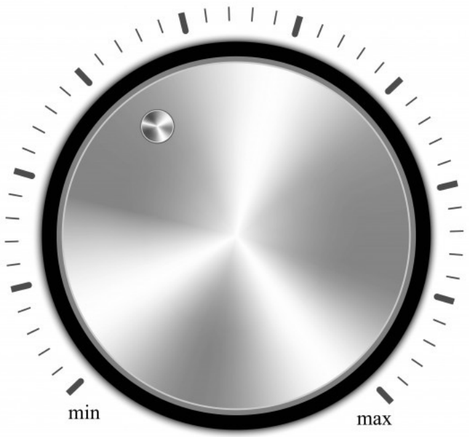
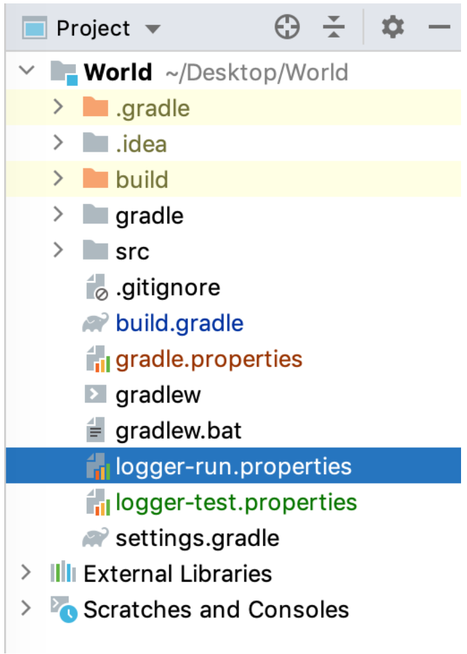


Configuration



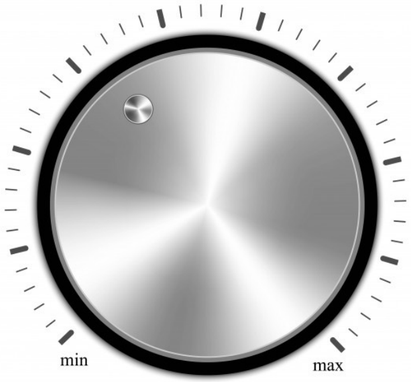

```
# Where should the logs be sent to
handlers = java.util.logging.ConsoleHandler

# What volume should be shown?
java.util.logging.ConsoleHandler.level = FINER

# How should each log entry be shown?
java.util.logging.ConsoleHandler.formatter = java.util.logging.SimpleFormatter

# What volume should be logged in general
.level = SEVERE

# What volume should be logged for a logger with a given name?
be.howest.ti.shop.Shop.level = FINE
```



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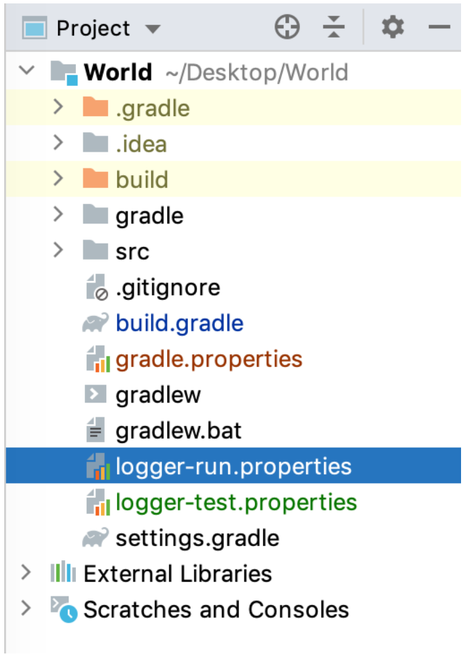


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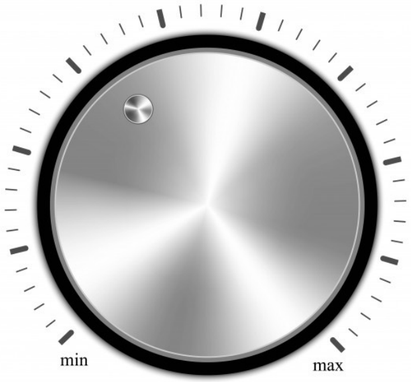

Configure the actual output. Here: to the console. Other options are file, network, …

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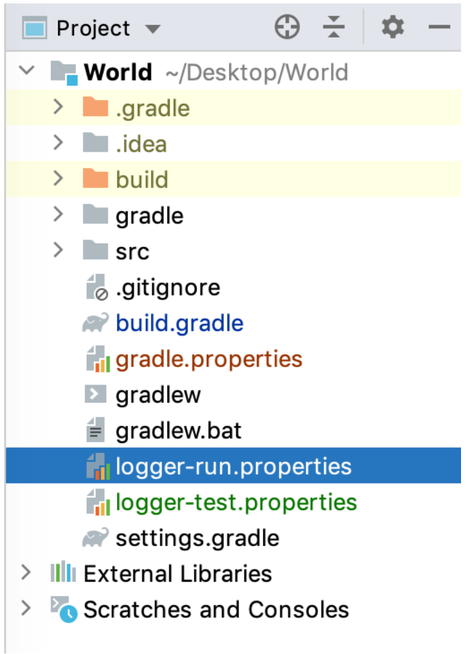
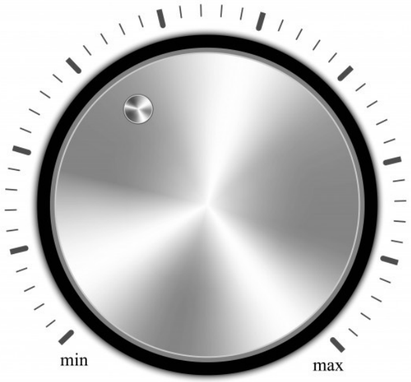
Configuration



Configure the actual LOGGER objects:

Which log events should be recorded

This is not the same as output



Can be done in general (e.g., .level)

Can be done per logger (i.e., by using (a part) of the name)

```
# What volume should be logged in general
.level = SEVERE

# What volume should be logged for a logger with a given name?
be.howest.ti.shop.Shop.level = FINE
```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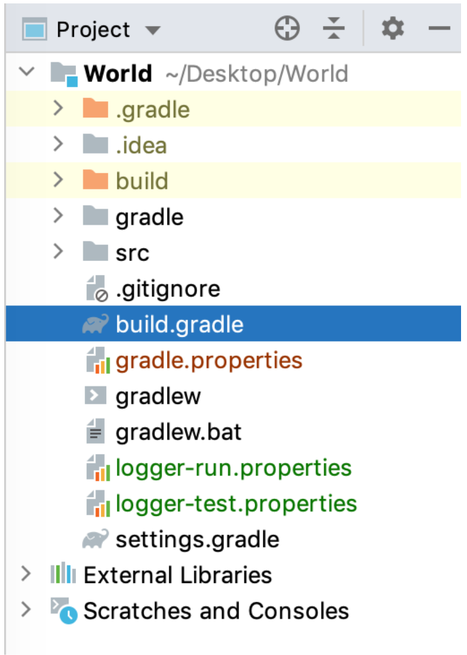
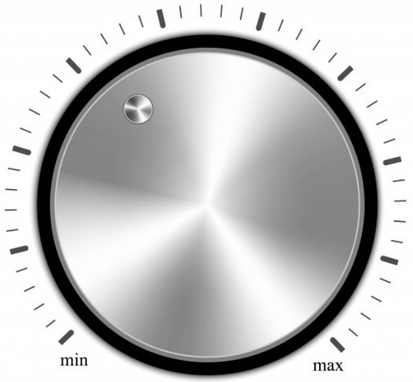
Some configuration is required in build.gradle!

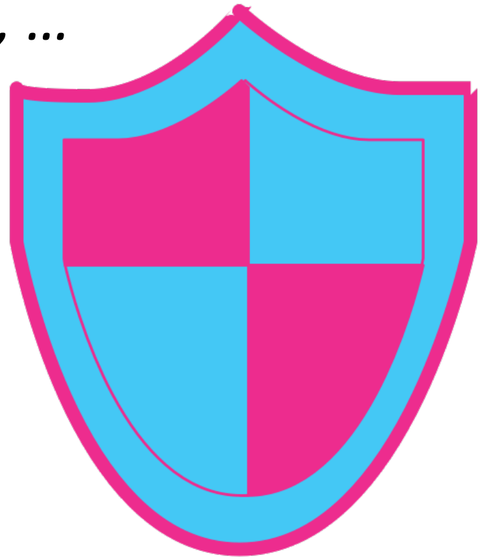



```
plugins {
    id 'java'
    id 'application'
}


mainClassName = 'be.howest.ti.shop.Program'

run {
    systemProperty("java.util.logging.config.file", "logger-run.properties")
}

test {
    systemProperty("java.util.logging.config.file", "logger-test.properties")
}
```



Secure Coding Guidelines

- **Guideline 1-1 / DOS-1:** Beware of activities that may use disproportionate resources
  - *Detailed logging of unusual behaviour may result in excessive output to log files.*
- **Guideline 2-2 / CONFIDENTIAL-2:** Do not log highly sensitive information
  - *E.g., do not log paswords or social security numbers or the like, …*



https://www.oracle.com/java/technologies/javase/seccodeguide.html