Usage & Customization Guide

Simple Thread■Safe Selenium Java Framework (Maven + TestNG + POM + Extent + Log4j2 + Parallel)

1) What this sample project gives you

- **Thread■safe parallel execution** using ThreadLocal<WebDriver> (each test thread gets its own driver).

- **TestNG** suite + parallel configuration in *testng.xml.*

- **POM structure** with page classes and clean tests.

- **Extent Reports** + screenshots on failure using a TestNG listener.

- **Log4j2 logging** to console and file.

- **RetryAnalyzer** to retry flaky failures (configured to 1 retry).

- **DataProviders** from Excel and from a demo DB (H2 in■memory).

- **Optional Selenium Grid** execution via config switch.

- **Jenkinsfile** for CI pipeline basics.

2) How to run (local + grid)

2.1 Run locally

Command:

```
mvn clean test
```

2.2 Run on Selenium Grid (optional)

Update **src/test/resources/config.properties**:

```
run.mode=grid grid.url=http://localhost:4444/wd/hub browser=chrome
```

Then run:

```
mvn clean test
```

3) What to customize for YOUR project

3.1 Application under test (AUT) URL

Change the base URL in **src/test/resources/config.properties**:

```
base.url=https://your-app-url/login
```

3.2 Browsers and capabilities

Local browser selection is controlled by **browser** in config.properties. Supported: chrome, firefox, edge.

```
browser=firefox
```

To add more options (headless, downloads, certificates, etc.), edit **DriverFactory**:

```
src/main/java/com/example/framework/driver/DriverFactory.java
```

3.3 Parallel execution tuning

Parallelism is controlled in **testng.xml**:

```
...
```

- Start with **parallel="classes"** if your project is new to parallel. Move to **methods** once stable.

- Keep tests independent: each test must create its own data or clean up after itself.

- Avoid shared static state (static driver, static page objects, global counters).

3.4 Thread■safe WebDriver (core concept)

- Never create **public static WebDriver driver**. Always use DriverManager.getDriver().

- Create the driver in **@BeforeMethod** and quit it in **@AfterMethod**.

- Always call **DriverManager.unload()** to remove ThreadLocal data and avoid memory leaks.

3.5 Pages and locators (POM customization)

- Create a new page class for each screen under **src/main/java/.../pages**.

- Do not keep locators in test classes; keep them in page classes.

- Avoid static WebElements/fields in pages.

- Return the next page object after navigation (e.g., login() returns DashboardPage).

3.6 DataProviders (Excel + DB)

- **Excel**: Replace demo file at src/test/resources/testdata/login-data.xlsx. Update parsing in ExcelUtils if you change columns.

- **DB**: Replace demo H2 DB logic in DBUtils with your real DB connection. Use secure credentials (env vars/Jenkins credentials).

- Do not share one DB Connection across threads; use try-with-resources per query or a connection pool.

3.7 Reports, screenshots, logging

- Extent report: **target/extent-report/ExtentReport.html**. Customize in ExtentManager.

- Screenshots: **target/screenshots** (unique names include thread id + timestamp).

- Logs: **target/logs/framework.log**. Customize pattern/appender in log4j2.xml.

3.8 Jenkins

- Jenkinsfile runs mvn clean test and archives extent-report/logs/screenshots.

- For parameterized CI runs, pass overrides like -Dbrowser, -Drun.mode, -Dgrid.url.

4) Copy/paste examples

Override settings from CLI/CI:

```
mvn clean test -Dbrowser=firefox -Drun.mode=grid -Dgrid.url=http://localhost:4444/wd/hub
```

Change parallel level in testng.xml:

```
parallel="classes" (safer) parallel="methods" (faster)
```

5) Troubleshooting

- **Random failures in parallel**: check for shared static state and non-unique test data.

- **Report mixing**: ensure ExtentTest is thread-local (already implemented).

- **Overwritten screenshots**: ensure unique naming (already implemented).

- **Session not found**: shared driver being quit by another test—fix by ThreadLocal driver + per-test teardown.

Want a version aligned to your banking modules (Login, Beneficiary, Fund Transfer, Statements)? Tell me modules and I will tailor this template.