



High Performance Reactive Programming with Java™ and JavaScript

Workshop Code:

IJ-18

Workshop domain:

Software Engineering

Duration of the workshop:

27 study* hours

Sofia, 2015

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2. Duration of a study hour is 45 minutes.



High Performance Reactive Programming with Java™ and JavaScript

STUDY PLAN

Module name	1. High Performance and Reactive Programming with Java
Lectures, study hours	9
Lab exercises, study hours	18
Total, study hours	27

Lecturer:

Trayan Iliev

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Target audience: Medium to expert level Java and JavaScript developers with practical experience in building web/server-side applications with Java and JavaScript.

Workshop duration: Duration of the workshop is 27 study hours in total divided in 3 days.

Workshop Description:

The workshop provides in-depth study of reactive and high performance (low latency + high throughput) client and server-side application programming in Java and JavaScript using several open-source frameworks. Main patterns and existing software implementations are discussed.

Functional reactive programming provides easy to use and composable higher-level abstraction for high-performance computing, hiding the complexities of non-blocking concurrency implementations. The main topics that will be covered are:

- Low latency and high throughput programming in Java. Different factors affecting performance – *CPU architecture* (multicore, hyperthreading), memory hierarchies (caches, predictive caching), *memory access patterns* (temporal, spatial, striding), *Garbage Collection* (serial, parallel and concurrent GC strategies, generational GC), *lock contention* – uncontended vs. contended locks, false sharing. *Non-blocking concurrency*. Single writer designs. The

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LMAX Disruptor (RingBuffer) high performance inter-thread messaging library. DSL & Main API – *Ring Buffer, Sequence, Sequencer, Sequence Barrier, Wait Strategy, Event, EventProcessor, EventHandler, Producer*. Examples and exercises. (6 study h.)

- *Reactive programming. Reactor & Proactor design patterns. Reactive Streams Specification – Publisher, Subscriber, Subscription, Processor*. Building high-performance non-blocking asynchronous applications on the JVM using *Reactor* project – *Reactors, Dispatchers, EventRouters, Streams and Promises, Processors (RingBuffer)*. *Reactor-Core, Reactor-Bus, Reactor-Streams and Reactor-Net APIs*. Building end-to-end reactive web applications and services (*REST, WebSocket*) using *Reactor*. (8 study h.)
- *RxJava* – a Java VM implementation of *ReactiveX (Reactive Extensions)* – extended *Observer* design pattern. Practical examples and *RxJava* coans for self-testing. (5 study h.)
- *RxJS* – *JavaScript* reactive programming using *Reactive Extensions*. Integration with *Facebook Reactor, Google Angular 2*. Practical examples for *end-to-end client-server reactive programming* using *Java, JS, HTTP* and *WebSocket*. (5 study h.)
- *Inter Process Communication (IPC)* with sub millisecond latency with *Chronicle Queue*. (3 study h.)

The workshop contains 30% lecture materials and 70% lab exercises. Lectures and exercises will be conducted in parallel and will not be divided in separate sessions in order to achieve immediate reinforcement of theoretical discussions with practical examples and exercises in Java and JavaScript (*RxJS, Facebook Reactor, Google Angular JS 2*). *RxJava* coans included.

The learning is conducted in small groups – up to 8 participants using problem-based methodology. During laboratory exercises there is opportunity for individual advises, as well as discussion of additional questions the participants are interested in.

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