Publication date : 03/26/2024

Course : Java, multithreaded programming

Practical course - 4d - 28h00 - Ref. JQT

Multithreaded programming in Java is becoming increasingly important thanks to the widespread use of multiprocessor architectures: it simplifies the design and development of applications with intrinsic parallelism, and offers effective solutions to performance problems.

Teaching objectives

At the end of the training, the participant will be able to:

- Master multithreaded programming models and the corresponding standard libraries
- Know the main data structures suitable for multithreaded programming
- Know the main bugs and get an overview of solutions
- Knowledge of test and debugging tools
- Understanding the links between multithreaded programming and performance

Intended audience

Developers, software architects and project managers.

Prerequisites

Basic knowledge of Java and the use of an IDE (Eclipse, IntelliJ...).

Course schedule

1 Multithreaded programming models, interfaces and classes

- Basic concepts: task, execution resource, activity, execution service, future.
- Various concept implementations (Runnable, Callable<T>, ExecutorService, Future<T>...).
- Uncaught exceptions, thread groups.
- The complete future.

Hands-on work

Programming an application combining the different models.

PARTICIPANTS

Developers, software architects and project managers.

PREREQUISITES

Basic knowledge of Java and the use of an IDE (Eclipse, IntelliJ...).

TRAINER QUALIFICATIONS

The experts leading the training are specialists in the covered subjects. They have been approved by our instructional teams for both their professional knowledge and their teaching ability, for each course they teach. They have at least five to ten years of experience in their field and hold (or have held) decision-making positions in companies.

ASSESSMENT TERMS

The trainer evaluates each participant's academic progress throughout the training using multiple choice, scenarios, hands-on work and more.
Participants also complete a placement test before and after the course to measure the skills they've developed.

2 Constraints on the correct behavior of activities

- Some formal specification methods.
- A semi-formal specification method.
- Implementing specifications.

Hands-on work

Use of formal specification methods.

3 Thread synchronization and communication

- Status "synchronized", "wait", "notify" and monitor programming.
- Synchronization interfaces and classes: locks, semaphores, cyclic barriers.
- Cue.

Hands-on work

Use interfaces and synchronization classes.

4 Parallel task execution

- ExecutorService.
- The fork/join model (RecursiveTask<T>, RecursiveAction, ForkJoinPool).

Hands-on work

Use of runtime services and the fork/join model.

5 Data structures dedicated to multithreaded programming

- Specialized collections.
- Local storage of thread data: ThreadLocal<T>.
- Atomic classes.

Hands-on work

Use of data structures.

6 Threads and performance

- The impact of thread creation.
- The impact of synchronization.
- The impact of memory caches.
- Threads and IOs, DBs and graphics.
- Threads and scheduling.

Hands-on work

Optimisation des programmes.

7 Alternative models

- Asynchronous models: JReact.
- Actor models (Akka Actor4J...).
- Synchronous reactive models.

TEACHING AIDS AND TECHNICAL RESOURCES

• The main teaching aids and instructional methods used in the training are audiovisual aids, documentation and course material, hands-on application exercises and corrected exercises for practical training courses, case studies and coverage of real cases for training seminars.
• At the end of each course or seminar, ORSYS provides participants with a course evaluation questionnaire that is analysed by our instructional teams.
• A check-in sheet for each half-day of attendance is provided at the end of the training, along with a course completion certificate if the trainee attended the entire session.

TERMS AND DEADLINES

Registration must be completed 24 hours before the start of the training.

ACCESSIBILITY FOR PEOPLE WITH DISABILITIES

Do you need special accessibility accommodations? Contact Mrs. Fosse, Disability Manager, at psh-accueil@orsys.fr to review your request and its feasibility.

8 Tools for developing competitive programs

- JConsole, jstack.
- The JArmus bookshop.
- Lamport's temporal logic: TLA+.
- Common errors: contention, dormancy, deadlock, premature termination.