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Bachelor's Thesis

A Kotlin Multiplatform Compiler Plugin to
Record Method Execution Times as OpenTelemetry Traces

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Kotlin, a versatile programming language, supports multiple platforms, including JVM bytecode, native binaries, and JavaScript. Performance monitoring is crucial in software development, and OpenTelemetry has become a standard for observability, offering APIs and tools to collect and analyze telemetry data.

Currently, a Kotlin compiler plugin developed at the Institute for System Software generates a custom trace format to record method calls, exits, and execution times. However, this format lacks standardization, limiting its interoperability. This bachelor's thesis aims to replace the custom trace format with OpenTelemetry traces, leveraging the standardized tracing format provided by OpenTelemetry.

The primary challenge is integrating OpenTelemetry with the Kotlin compiler plugin to support Kotlin's multiplatform capabilities. This involves ensuring the plugin works seamlessly across all Kotlin targets. For this, the thesis might utilize the OpenTelemetry Kotlin library, a multiplatform port of OpenTelemetry Java, available on GitHub by the user dcxp [1].

Goals:

- Analyze the existing Kotlin compiler plugin.
- Integrate the OpenTelemetry Kotlin library into the compiler plugin.
- Ensure compatibility with all Kotlin targets.

Adopting a standardized tracing format will enhance the interoperability of performance monitoring tools, benefiting software developers, performance engineers, and the open-source community.

The expected outcome is a functional Kotlin multiplatform compiler plugin that records method execution times as OpenTelemetry traces. The final result should also be published as a short paper at the Symposium for Software Performance 2025 [2].

Modalities:
The progress of the project should be discussed at least every four weeks with the advisor(s). A time schedule and a milestone plan must be set up within the first 2 weeks and discussed with the advisor(s). It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than 31.08.2025.

[1] https://github.com/dcxp/opentelemetry-kotlin
[2] https://www.performance-symposium.org/ - Abstract Deadline: 18.08.2025, Paper Submission Deadline: 25.08.2025. 3 pages