An Exploration of Specialized Java Bytecodes
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Java bytecodes are a machine readable representation of a computer program written using the Java programming language. Each bytecode serves a specific purpose such as performing an arithmetic operation or copying a value from one memory location to another. The Java Virtual Machine Specification defines the functionality of 201 distinct bytecodes. Some bytecodes provide unique functionality that is not easily duplicated by other bytecodes. Others perform tasks that are easily mimicked by either one other bytecode or a short sequence of bytecodes. Those bytecodes that provide unique functionality will be referred to as core bytecodes while the remaining bytecodes will be referred to as specialized bytecodes.

This study discusses techniques used to replace 67 specialized bytecodes with equivalent core bytecodes. Performance results are presented showing that substituting infrequently executed specialized bytecodes does not impact the performance of applications in a statistically significant manner.

The introduction of new specialized bytecodes was also considered. Profiling was used to determine what numeric values are used frequently with core bytecodes. This information has revealed many additional values that can be used for specialization. Furthermore, some of these recently determined values occurred much more frequently than values currently in use. Performance results are presented showing the performance change observed when the new specialized bytecodes were implemented. Recommendations for modifications to the Java Virtual Machine Specification based on these results are also discussed.