Summary Part 1
A Survey of Adaptive Optimization in Virtual Machines

Mrinal Nath (ID: 3307043)
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What are the problems solved by this paper?
This is a survey paper and reviews the development of adaptive optimization technology in VMs. VMs offer several advantages over statically compiled binaries: portable program representations, safety features, built-in memory and thread management, dynamic program composition, etc. However, these features limit the usefulness of traditional static program optimization techniques. Hence, there is a need for performing dynamic (adaptive) optimizations in VMs. This paper reviews such techniques.

What are the approaches attempted by this paper?
It categorizes adaptive optimization techniques into three types: (1) selective optimization – when and where to apply a runtime optimization; (2) feedback-directed code generation – using profiling information to improve the quality of code generated; and (3) other feedback-directed optimizations – techniques for improving the temporal and/or spatial locality of generated code, optimizations for runtime services, better techniques for heap management and garbage collection. In each category, a survey of past research and the state-of-the art is presented. The paper also reviews profiling techniques.

What are the main conclusions of this paper?
selective optimization is currently the most widely used adaptive optimization in VMs. Feedback-directed optimizations are beginning to be employed in production VMs. There is a need for a more theoretically-grounded policies for selective optimizations. Profiling and feedback-directed optimizations present several research opportunities. Architectural impact of VMs should be considered, since dynamic code generation can help in some cases (e.g. solving legacy problem for VLIWs). VMs will also be useful in embedded systems where there are several ISAs and this domain of application of VMs will present several new challenges.