

BBQ - A Simple and Effective Approach to Backward Branch Predictions for Embedded Processors

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Abstract. The problem of control hazard induced by branch instructions is important for the modern processors. Although there are many solutions been proposed for the problem, most of these solutions may not suitable for the embedded processors. Our research tries to find a *smart* way to provide a cost-effective function of branch prediction for embedded processors. By classifying branch behaviors into forward and backward branches, this paper first focuses on backward branches to develop a favorable solution for the instructions. A novel approach named *Backward Branch prediction Queue*, or BBQ is proposed to predict the outcomes of backward branches efficiently. This study shows that BBQ is able to retain good prediction accuracies at a small fraction of the hardware costs and complexities. Although a hardware-frugal approach like BBQ is inevitably less accurate than the luxurious prediction mechanisms, it nevertheless creates new tradeoff points of costs and performance that best suit the application domains of embedded processors. Moreover, the prediction mechanism will trace the execution flow to identify the current position in a nested loop. The information of current position will be contributive to the prediction of forward branches.

Keywords: branch prediction, embedded processor, pipeline, loop prediction

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