

A Conceptual Framework for Computer Architecture*

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The purpose of this paper is to describe the concepts, definitions, and ideas of computer architecture and to suggest that architecture can be viewed as composed of three components: physical organization; control and flow of information; and representation, interpretation and transformation of information. This framework can accommodate diverse architectural concepts such as array processing, microprogramming, stack processing and tagged architecture. Architectures of some existing machines are considered and methods of associating architectural concepts with the components are established. Architecture design problems and trade-offs are discussed in terms of the proposed framework.

Keywords and Phrases: computer architecture, framework, composition of architecture, information flow, physical organization, unification of diverse architectural concepts.

CR Categories: 6.0, 6.20, 6.22, 6.29.

INTRODUCTION

Computer architecture is receiving, and will continue to receive special attention as novel architectures differing from the classic von Neumann organization emerge as viable approaches to the problem of increasing the computational speeds and cost-effectiveness of computer systems. Computers such as the CDC 6600, CDC STAR-100, TI ASC, Burroughs B6700, Goodyear STARAN and CRAY-1 are convincing arguments that architecture plays a prominent role in deciding computer system performance and in achieving faster computational speeds than has been pre-

viously possible. In the literature there is a multitude of proposals as to how computer architecture can be defined and how an architect's job can be described. Unfortunately, most of these proposed concepts touch only different facets of computer architecture and do not encompass the complete spectrum of architectures. In this paper we present a conceptual viewpoint that allows a coherent and unified treatment of computer architecture. We believe that computer architecture can be viewed as composed of 1) physical organization; 2) control and flow of information; and 3) representation, interpretation and transformation of information, and we develop a framework for architecture based on this viewpoint. We consider some existing com-

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