

The Ideal Memory Substitute for Computer Memory Hierarchy

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Abstract : Computer system components such as the CPU, the Controllers, and the operating system, work together as a team, and storage or memory is the essential parts of this team apart from the processor. The memory and storage system including processor caches, main memory, and storage, form basic storage component of a computer system. The characteristics of the different types of storage are inherent in the design and the technology employed in the manufacturing. These memory characteristics define the speed, compatibility, cost, volatility, and density of the various storage types. Most computers rely on a hierarchy of storage devices for performance. The effective and efficient use of the memory hierarchy of the computer system therefore is the single most important aspect of computer system design and use. The memory hierarchy is becoming a fundamental performance and energy bottleneck, due to the widening gap between the increasing demands of modern computer applications and the limited performance and energy efficiency provided by traditional memory technologies. With the dramatic development in the computers systems, computer storage has had a difficult time keeping up with the processor speed. Computer architects are therefore facing constant challenges in developing high-speed computer storage with high-performance which is energy-efficient, cost-effective and reliable, to intercept processor requests. It is very clear that substantial advancements in redesigning the existing memory physical and logical structures to meet up with the latest processor potential is crucial. This research work investigates the importance of computer memory (storage) hierarchy in the design of computer systems. The constituent storage types of the hierarchy today were investigated looking at the design technologies and how the technologies affect memory characteristics: speed, density, stability and cost. The investigation considered how these characteristics could best be harnessed for overall efficiency of the computer system. The research revealed that the best single type of storage, which we refer to as ideal memory is that logical single physical memory which would combine the best attributes of each memory type that make up the memory hierarchy. It is a single memory with access speed as high as one found in CPU registers, combined with the highest storage capacity, offering excellent stability in the presence or absence of power as found in the magnetic and optical disks as against volatile DRAM, and yet offers a cost-effective attribute that is far away from the expensive SRAM. The research work suggests that to overcome these barriers it may then mean that memory manufacturing will take a total deviation from the present technologies and adopt one that overcomes the associated challenges with the traditional memory technologies.

Keywords : cache, memory-hierarchy, memory, registers, storage

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