TOP SHEET

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CONTINUOUS ASSESSMENT (CA) – ODD / EVEN SEMESTER 2023

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(Please tick the applicable one)

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"Hybrid Memory Architecture"

ABSTRACT:

A Hybrid memory architecture is computer memory architecture that combines multiple types of memory technologies to improve performance and efficiency. In this report, we explore the concept of HMA, its challenges and the high cost of some memory technologies. Further more, we analyze the advantages of HMA, which include faster access times, increased memory capacity, and reduced power consumption. we find that HMA has the potential to significantly improve computer memory performence and efficiency, but its implementation requires careful consideration of the various trade-offs involved.

INTRODUCTION:

Hybrid memory architecture is a computer memory architecture which combines both shared & distributed memory architecture, to provide a balance of performence, capacity, and cost. By using a combination of DRAM and NVM, HMA can achieve both fast access to data and efficient data storage. The two types of memory used in HMA are typically Dynamic Random Access Memory and Non-Volatile Memory like NAND flash or Intel's Optane Memory.

Problem Definition

In this HMA System, data is dynamically allocated to different memory types based on access patterns and frequency. Frequently accessed data is stored in faster memory, such as DRAM while less frequently accessed datd is stored in slower but more cost effective memory,
HMA system are commonly used in mordern computing devices such as smartphone, laptops. It can also be used in server and data center environments to improve the efficiency and cost-effectiveness of memory subsystems.

Discussion

Hybrid memory architecture aims to address some of the challenges associad with the use of DRAM as the primary memory in computing system. By using a combination of DRAM and NVM, HMA can achieve both fast access to data and efficient data storage. In HMA the DRAM is used as a cachonstraintse for frequently accessed data. This approach allows for larger memory capacity and higher efficiency without compromising performance.

- The shared memory component is usually a cache coherent SMP machine. Processors on a given SMP can address that machine's memory as global.
When HMA and shared memory are used together the shared memory component can be implement using the DRAM component of the HMA.
This approach can offer several benefits.
  (i) Faster access to shared memory,
  (ii) Improved efficiency,
  (iii) Reduced Cost,
  (iv) Increased capacity,

  * Here HMA can offer larger memory capacity than DRAM alone.

- The distributed memory component is usually a ~~cache~~ networking of multiple SMPs. SMP know only about their own memory - not the memory on another SMP. Therefore, network communications are required to move data from one SMP to another.

- Current trends seem to indicate that this type of memory architecture will continue to prevail and increase at the high end of computing for the foreseeable future.

  • Charecteristics-
    (i) Non-Volatile ROM
    (ii) EEPROM
    (iii) Fast Read
    (iv) Not fast write.

Advantage & Disadvantage

- **Advantages**

(i) **Increased memory capacity:** HMA allows for larger memory capacity compared to using DRAM alone.

(ii) **Improved Performance:** By using combination of diffrent memory, HMA can achive better performance than DRAM.

(iii) **Lower power comption:** The system can operate more efficiently, reducing power consumption and potentially increasing battry life in mobile devices.

(iv) **Cost-effective:** HMA can be a cost-effective soln for increasing memory capacity while maintaining performence

- **Disadvantages**

(i) **Complexity:** Implementing HMA can be comlex, requiring specialized hardware and software to manage the combination of DRAM and NVM components.

(ii) **Latency:** Although DRAM component of HMA can provide fast access to frequency accessed data, there may still be ~~fat~~ latency issues when accessing NVM component.

(iii) **Reduce security:** NVM is more vulnerable to security attacks compared to DRAM, which can be a concern for applications that require high security.

CONCLUSION:

Hybrid memory architecture is a new approch that leverages both volatile memory, such as dynamic random access memory and non-volatile memory, such as solid state dride (SSD) and flash, to deliver

Consistent, trusted, reliable, and low-latency access to to data in order to support existing and new generations of transactional, operational and analytical applications. This benefits make it a better option for modern computing systems.

REFERENCE:

(i) www.youtube.com
(ii) www.openai.com
(iii) Class notes
(iv) Classroom lectures.