Paper Critique – Week 14

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mClock: Handling Throughput Variability for Hypervisor IO Scheduling

Nowadays, virtual machine (VM) technique is popularly employing in many operating. The hypervisor's mission is enforce providing each virtual machine with the illusion of owning dedicated physical resources. Unlike CPU and Memory allocation which is the fixed capacity resource, IO throughput is usually fluctuated caused by other VM run on the same storage infrastructure.

This paper proposed a clever algorithm for IO scheduler in the presence of in the presence of capacity fluctuations at short time scales. This algorithm leveraged using sophisticated controls that are: reservations & limit (absolute units express the minimum reservation and maximum limitation of IO resource required by VM) and share (relative allocation measure that specify the ratio in which the different VMs receive service). The general idea is to allocate the resource to the VMs in proportion to their shares, subject to the constraints that each VM receives at least its reservation and no more than its limit.

The strength of this paper is that author not only propose IO scheduler but also consider the case that storage infrastructure are deployed as multiple distributed nodes. Thus, they extended their algorithm to a distributed version. Finally, they implemented their proposed inside VMware ESX server hypervisor and conducted evaluation.

The paper will be more informative if it came up with some comparison with other hypervisors such as QEMU, VirtualBox.

FlashFQ: A Fair Queueing I/O Scheduler for Flash-Based SSDs

The Flash-based SSDs are more and more used in modern computer systems. Unlike the traditional HDDs at which frequent task switches induce high seek and rotation costs, this is only a minor concern for Flash-based SSDs due to diminished benefits of I/O spatial proximity on modern SSD firmware. Because of that, time-slice technique which is employed by traditional IO scheduler will exposure the unresponsiveness.

In order to remove the harmful unresponsiveness in computer system that armed the SSD as the secondary storage, this paper introduce a new IO scheduler – FlashFQ tailored to Flash-based SSD that obtains both the fairness and responsiveness. By leverage unique characteristic of SSD which are: "restricted parallelism with interference on SSDs presents a tension between efficiency and fairness" and "the diminished benefits of I/O spatial proximity on SSDs allow fine-grained task interleaving without much loss of I/O performance"; FlashFQ outperformed other operating system IO schedulers which were designed for traditional HDD.

The strength of this paper is that the author evaluated their proposed with real-world workloads (Apache web server and Kyoto Cabinet key-value store). This convinced audience that their solution is necessary for our modern computer system.

And further discussion how FlashFQ work with other storage technique such as RAID, JBOD are welcomed.