FAWN: A Fast Array of Wimpy Nodes

NOTE: Your slides/presentation need to cover the assigned sections and questions in a clear and well-organized manner. You are allowed to borrow contents from other resources, such as online slides, as long as you acknowledge them. For a slide that covers a given question, please print the question on the slide where it is covered. However, you don’t have to answer the question using a long paragraph of text on the slide. Instead, use bullet points, graph, animation, or oral explanation to answer the question. In your Q&A report, use text to more thoroughly answer the questions.

Only need to cover sections before Section 3.3.2.

(1) “The workloads these systems support share several characteristics: they are I/O, not computation, intensive, requiring random access over large datasets, ..., and the size of objects stored is typically small.” Read the above statement, indicate why workloads of these characteristics represent a challenge to the system design?

(2) “The key design choice in FAWN-KV is the use of a log structured per-node datastore called FAWN-DS that provides high performance reads and writes using flash memory.” “These performance problems motivate log-structured techniques for flash filesystems and data structures” What key benefit does a log structured data organization bring to the KV store?

(3) “To provide this property, FAWN-DS maintains an in-DRAM hash table (Hash Index) that maps keys to an offset in the append-only Data Log on flash.” What are potential issues of the design? [Hint: consider metadata size and volatility of DRAM.]

(4) “It stores only a fragment of the actual key in memory to find a location in the log;” Is there correctness concern in this design?

(5) “Basic functions: Store, Lookup, Delete” Use Figure 2(a) to explain how these basic functions are executed?

(6) “As an optimization, FAWN-DS periodically checkpoints the index by writing the Hash Index and a pointer to the last log entry to flash.”. Why does this checkpointing help with the recovery efficiency? Why is a Delete entry needed in the log for a correct recovery?