FAWN: A Fast Array of Wimpy Nodes

NOTE: Your slides/presentation only need to cover background information necessary to answer the given 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. The presentation should be mostly question-focused and proceed mostly in a Q&A format. Please include the questions in your slides. Don’t write detailed answers in the slides and read them to the class. Instead, use bullet points, graphs, or animations to explain your answers to the class.

In your Q&A report, use text to more thoroughly answer the questions. Include a short paragraph at the beginning of the report to summarize the paper.

(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 a correction 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? How is a KV item deleted from the store?