eNewsletter

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Content-addressable memory (CAM) turns the tables on conventional memory approaches. CAMis tailor-made for accelerating searches through massive data tables, making it a prime candidate for such things as routing tables and policy.

Most memory devices store and retrieve data by addressing specific memory locations. As a result, this path often becomes the limiting factor for systems that rely on fast memory access. The time required to find an item stored in memory can be reduced considerably if the stored data item can be identified for access by the content of the data itself rather than by its address. Memory that is accessed in this way is called content-addressable memory (CAM). CAM provides a performance advantage over other memory search algorithms (such as binary and tree-based searches or look-aside tag buffers) by comparing the desired information against the entire list of prestored entries simultaneously, often resulting in an order-of-magnitude reduction of search time.

CAM is ideally suited for several functions, including Ethernet address lookup, data compression, pattern-recognition, cache tags, high-bandwidth address filtering, and fast lookup of routing, high-bandwidth address filtering, user privilege, security, or encryption information on a packet-by-packet basis for high-performance data switches, firewalls, bridges, and routers. This article discusses several of these applications as well as hardware options for using CAM.

CAM basics

Since CAMs are an outgrowth of RAM technology, in order to understand a CAM, it helps to contrast it with a RAM. RAM is an integrated circuit that stores data temporarily. Data is stored in RAM at a particular location, which is called an address. In RAM, the user supplies the address and gets the data back. The number of address lines limits the depth of a memory using RAM, but the width of the

memory can be extended as far as desired. With CAM, the user supplies the data and gets the address back. The CAM searches through the memory in one-clock cycle and returns the address where the data is found. The CAM can be preloaded at device startup and rewritten during device operation.

CAM can accelerate any application requiring fast searches of databases, lists, or patterns, such as in image or voice recognition, or computer and communication designs. For this reason, CAM is used in applications where search time is critical and must be very short. For example, the search key could be the IP address of a network user, and the associated information could be a user's access privileges and location on the network. If the search key presented to the CAM is present in the CAM's table, the CAM indicates a match and returns the associated information, which consists of the user's privileges. A CAM can thus operate as a data-parallel or single instruction/ multiple data (SIMD) processor.

CAM can be used to accelerate any application ranging from LANs, database management, file-storage management, and table look up to pattern recognition, artificial intelligence, fully associative and processor-specific cache memories, to disk cache memories. Although CAM has many applications, it's particularly well suited to performing search operations.
In each one of these applications the user may not know the addresses of words that have particular pieces of information stored within a specific portion of the word length.

Data Compression with CAM
Data compression removes the redundancy that resides in a given piece of information, producing an equivalent but shorter message.
CAM is well suited for data compression because the movement of packets through a LAN requires some form of address translation. Since a good portion of a compression algorithm's time is spent searching and maintaining these data structures, replacing the algorithms with a hardware search engine can greatly increase the throughput of the algorithm.
In a data compression application, CAM lookup is performed after each word of the original data is presented. If the code corresponding to the word bit pattern in the input register is found, then the appropriate symbol or token is output and the input register is flushed. If the code is not found in the CAM, then another word is shifted in. A CAM will generate a result in a single transaction regardless of table size or search list length. This property makes CAM an ideal candidate for data compression schemes that use sparsely populated tables as part of their algorithm.

eFlexCAM by SDS:

eFlexCAM compilers provide high efficiency, cost-effective solutions for CAM memory. Single/multi instances are valible for varity of founderies and process. more info

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