ALDC and a pre-processor extension, BLDC, provide ultra fast compression for general-purpose and bit-mapped image data

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IBM Microelectronics Division has developed a number of fast data compression hardware designs based on the use of a CAM, or Content Addressable Memory array.

The regular structure of the CAM is especially effective for implementation of compression algorithms of the LZ-1 type in CMOS technology. The CAM holds the History data, and it also is used to perform an exhaustive parallel comparison between each byte of incoming data and ALL History locations, called an exhaustive search, in one CAM cycle. This has significant implications for speed, compression, and hardware size.

Our LZ-1 variant, called ALDC, is able to compress data at a rate of 40 MB/sec as a separate chip, in our 0.8 micron CMOS process technology. Further, the exhaustive search allows an ALDC implementation to compress data quite effectively using only a 512 byte History size. Software LZ-1 approaches use a hashed partial search, to obtain adequate speed, so in order to achieve comparable compression they need a larger History size compared to ALDC, typically 2048 bytes. In our advanced 0.5 micron CMOS process, our latest ALDC design needs a chip area of only about 7.5 square mm, 1/10 of the area available on a typical sized CMOS chip, and runs at 50 MBytes/second.

An algorithm extension, called BLDC, has been developed more recently, suited for bit-mapped image data applications such as page image storage in laser printers. A conventional LZ-1 algorithm does not perform well on this type of data, but if a simple pre-processor is used to run code the data first, a subsequent LZ-1 compression step is much more effective. The BLDC extension simply encodes runs of consecutive 0's or 1's as 8-bit run counts, these are then fed into an ALDC encoder for further compression. Little extra Silicon area is needed to implement such an approach, and compression speed is just as fast as ALDC. Typical bitmap data is compressed some 1.5X to 1.6X better than ALDC, the maximum compression ratios for ALDC and BLDC being about 90:1 and 2700:1 respectively.