

Convey Computer™ Smith-Waterman Personality



By dramatically improving Smith-Waterman performance, Convey makes it practical for researchers to use the algorithm on a wider variety of problems, achieve more accurate results, and significantly reduce costs.

Searching databases for similarities is one of the most basic and important tasks in bioinformatics. For more than 25 years, the Smith-Waterman (S-W) algorithm has remained the gold standard for conducting these searches. Matching unknown strings—whether of DNA sequence or amino acids—against a known reference database enables researchers to make sense of the data deluge spilling from next-generation experimental technologies.

Smith-Waterman comprehensively searches for all possible matches between a query string and a reference and returns the most accurate match possible. Such searches are compute-intensive and time-consuming, especially when run on commodity computers. Consequently, S-W use declined somewhat in recent years as researchers sacrificed accuracy for speed with alternative algorithms. Convey Computer puts the gold standard back within practical reach of most applications with its accelerated Smith-Waterman personality for its HC-1 and the HC-1^{ex} computers.

ACHIEVE SPEED AND ACCURACY

Convey's new S-W personality achieves the fastest S-W performance on a single-node computer system. A single Convey HC-1^{ex} is as fast as *ten* 12-core commodity systems performing a FASTA SSearch.

In many cases, this makes Convey's S-W personality competitive with the performance of BLASTp, with much higher accuracy. Convey's solution starts with its innovative hybrid-core platforms—the HC-1 and the HC-1^{ex}—that use reconfigurable technology and a parallel memory subsystem to accelerate applications and lower cost of ownership. Convey's hybrid-core architecture pairs classic Intel® x86 microprocessors with a coprocessor comprised of FPGAs. Particular algorithms—such as Smith-Waterman—are optimized and translated into code that's loaded onto the FPGAs at runtime to accelerate applications that use these algorithms.

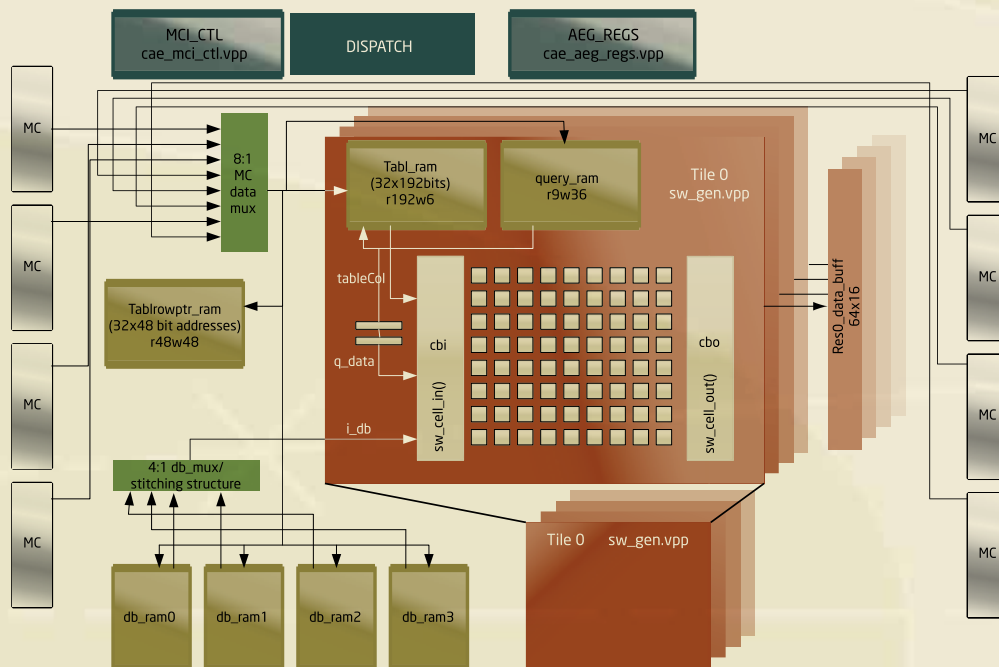
Convey implements S-W in four tiles on each FPGA application engine. Each tile is a traditional Smith-Waterman search algorithm laid out as a systolic array unrolled in hardware, which maximizes parallel efficiency without sacrificing accuracy. Queries are loaded into each tile, and two or four tiles may be joined to enhance performance for longer queries. Convey's HC-1^{ex} system is able to update as many as 5120 cells of the S-W array each clock cycle, or 768 GCPUS (billion cell updates per second).

The World's First Hybrid-Core Computer.

LEARN MORE ABOUT THE WORLD'S FIRST HYBRID-CORE COMPUTER.
VISIT CONVEYCOMPUTER.COM OR CALL 1-866.338.1768

PERSONALIZATION

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Performance-critical portions of the Smith-Waterman algorithm are implemented directly in hardware on the Convey coprocessor.

GO FOR THE GOLD

The dramatic S-W performance improvement makes it practical for researchers to use S-W for a wider variety of problems and to achieve much faster results for tasks on which S-W's accuracy is required. Convey's Smith-Waterman personality is available on HC-1 and HC-1^{ex}. The Convey S-W implementation provides many important advantages for researchers:

- **Ease of use.** S-W may be called as a simple subroutine or easily incorporated via an API (Application Programming Interface) into any application using Smith-Waterman.
- **High accuracy.** Studies have repeatedly shown S-W is by far the most accurate algorithm for achieving similarity searches.
- **Lower Cost.** For comparable performance, Convey achieves a 67 percent reduction in required space;

78 percent reduction in data center watts; and a 51 percent lower total cost of ownership over the highest-performing commodity servers available today.

- **Efficiency.** Convey S-W is very efficient for searching a database with many short strings as well as handling long reference sequences (>1B).

Other similarity searching algorithms—many derived from S-W—are available but Smith-Waterman remains the gold standard. Why not go for the gold with Convey's S-W personality?

Convey's innovative hybrid-core computer system marries the low cost and simple programming model of a commodity system with the performance of a customized hardware architecture. For more information, please see www.conveycomputer.com.

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