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Convey's New Burrows-Wheeler Alignment Delivers 15x Increase in Research Efficiency

BWA Personality Is Newest Addition to Convey's Expanding Bioinformatics Suite

Richardson, Texas—October 11, 2011—Convey Computer, the leader in hybrid-core computing, today introduced the Convey Burrows-Wheeler Aligner (BWA) personality to dramatically accelerate genome reference mapping and enable researchers and clinicians to more rapidly and cost-effectively identify variants.

BWA joins Convey's expanding bioinformatics suite of personalities that includes the Convey GraphConstructor™ for *de novo* short read assembly and Smith-Waterman for local sequence alignment. BWA—based on the Burrows-Wheeler Transform (BWT) function—is the preferred algorithm for fast reference mapping of short reads typical of high-throughput sequencers (HTS).

The implementation of BWA on Convey's innovative hybrid-core architecture has demonstrated impressive performance gains over commodity clusters. When mapping reads to a human genome, including both the align and paired-end steps, Convey's implementation increases the rate of reads mapped by a factor of 15 over a commodity server.[1] Such performance increases accelerate workflows that require mapping, such as SNP calling, variant analysis, and RNA expression profiling.

[1]Based on BWA 0.5.9 full workflow *aln* on 2 sequences + *sampe* 12C x86 (3.33 GHz) 15x over BWA x86 at 120 K reads/sec on HC-1^{ex}.

Convey's BWA performance increases lead to multiple computing efficiencies for researchers. Not only are researchers able to solve bigger problems in less time, Convey's hybrid-core computers are energy and space efficient. For example, eight Convey HC-1^{ex} systems provide the same performance as 120 12-core commodity servers, while using 75 percent less floor space and 79 percent less power. Over three years, that is a 60 percent reduction in total cost of ownership.

Additionally, Convey's systems are proving to be powerful departmental computer solutions, allowing researchers to solve "big data" problems without having to copy enormous data sets or schedule time on a large centrally managed cluster.

"Reference mapping is a critical step in identifying how closely genetic samples map to or, more importantly, differ from a reference genome. Accelerating this knowledge discovery in the rising tide of next-generation sequence data is central to increasing research productivity," said Bruce Toal, CEO and co-founder of Convey Computer. "The Convey BWA implementation dramatically improves efficiency and allows researchers get results faster, such as when profiling a cancer tumor. Adding BWA to our Convey Bioinformatics Suite reflects our ongoing commitment to the bioinformatics and life sciences community."

Driven by the rapid growth of next-generation sequencing, reference mapping is an increasingly critical tool for aligning sequence reads against a known reference genome to discover variation (SNPs, indels, and CNVs) as well as for ChIP-seq and RNA-seq applications.

Convey's novel hybrid-core computing architecture is key to improving BWA performance. Software-only applications are limited by the performance of commodity servers executing a stream of general-purpose instructions. Convey's architecture pairs classic Intel® x86 microprocessors with an FPGA-based

coprocessor. This architecture allows key segments of an application—traversal of a Burrows-Wheeler index, for instance—to run directly in hardware.

Besides raw processing power, Convey's highly parallel memory subsystem allows application-specific logic to concurrently access 8,192 individual words in memory, significantly increasing effective memory bandwidth over cache-based memory systems. Performance of many bioinformatics algorithms is constrained on traditional architectures by access to memory. The Convey BWA personality is faster and more efficient than other reference mapping algorithms because of Convey's enhanced memory access.

While Convey's personality optimizes BWA for the Convey hybrid-core platform, care was taken to minimize changes to the software itself and to maintain ease of use for users already familiar with BWA. In particular, Convey's implementation supports all the command line arguments and generates the same results as the non-accelerated original software.

About Convey Computer Corporation

Based in Richardson, Texas, Convey Computer breaks power, performance, and programmability barriers with the world's first hybrid-core computer—a system that marries the low cost and simple programming model of a commodity system with the performance of a customized hardware architecture. Convey brings decades of experience and intellectual assets to performance problem solving. Its executive and design teams all come from successful backgrounds of building computer companies, most notably Convex Computer Corporation and Hewlett-Packard. Convey Computer investors include Braemar Energy Ventures, CenterPoint Ventures, Intel Capital, InterWest Partners, Rho Ventures, and Xilinx. More information may be found at: www.conveycomputer.com.

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