Convey Computer™ Financial Analytics Personality

By implementing many commonly used financial analytics functions directly in hardware, analysts can get performance unattainable with commodity servers.

If you're a quantitative analyst, database/IT professional, or financial-services analyst, you need more computing power. Today financial analytics is all about beating your competitor (who has the same information that you have) to the next profitable decision. The problem is that financial instruments are getting more complex; there's fiercer competition, and the consequences of making the wrong decision have more impact.

But if analysts need performance, IT faces a corresponding challenge—where to put, and how to power and cool, any new equipment. A year's worth of facility costs for an off-the-shelf server can now cost more than the server itself.[1]

Both of these issues have a common solution: breaking through the power/performance wall that exists today with off-the-shelf computing platforms. If you can get orders of magnitude more performance in the same space, without mangling source code or disrupting datacenter workflows, you will have a competitive advantage.

One answer is the Convey hybrid-core computer—the HC-1™— that extends a commodity instruction set with hardware-based, application-specific instructions to accelerate your financial analytics applications.

[1] "In the data center, power and cooling costs more than the IT equipment it supports," Christian L. Belady, P.E., Hewlett-Packard Electronics Cooling, February 2007

PERSONALITIES FOR PROFITS

The Convey HC-1 hybrid-core computer provides personalities (custom instruction sets) that run on the HC-1 hardware-based application engines (AEs). The application-specific instructions can provide orders of magnitude more performance for specific functions.

Convey has developed a financial analytics personality (FAP)—an instruction set specific to financial applications. Specifically, the FAP accelerates certain intrinsic functions, such as the cumulative distribution function, and different forms of random number generation. The Convey coprocessor uses IEEE defined 64-bit double precision arithmetic, and has accuracy consistent with performing the same intrinsic operations using the host's x86 instruction set.

Access to the enhanced performance provided by the FAP personality is as easy as recompiling your application with the Convey ANSI standard compilers. The compilers automatically recognize intrinsic usage, and generate optimized code that leverages the Convey HC-1 financial analytics instruction set.

And, because the HC-1 is based on a commodity processor, runs a standard Linux® operating system, and supports industry-standard connectivity, it will fit neatly into your datacenter without disrupting software developers or your IT infrastructure.

The World's First Hybrid-Core Computer.

Convey Computer™ Financial Analytics Personality

FINANCIAL ANALYTICS PERSONALITY INSTRUCTIONS

Intrinsic Operations

Natural Logarithm, Exponential, Square Root
Reciprocal, Sine, Cosine
Error Function
Normal Cumulative Distribution Function (CDF)

Random Number Generation

Mersenne Twister Random Number Generation
Sobol Quasi-Random Number Generation

Vector Reciprocal Approximation Operations

Double Precision Reciprocal Approximation
Double Precision Square Root Approximation

INTRINSIC OPERATIONS

The FAP provides hardware support for functions frequently used by financial analytic applications, including random number generation and math intrinsics. Most of these are recognizable by the Convey compilers (depending on the structure of the source code), which will automatically generate the appropriate code to engage the Convey computational hardware.

The FAP intrinsic operations are implemented as Taylor series approximations applied to very small spans. Each span defines a base input value that is either at the beginning or end of the span. Span width is variable across the different regions of the function, and is chosen to ensure the accuracy tolerance of 1×2^{-51} (two least significant bits of double precision accuracy). The benefit of using the two-term Taylor series is extremely fast execution without compromising accuracy.

RANDOM NUMBER GENERATION

The Convey HC-1 hardware supports up to 32 independent parallel Mersenne Twister generators per node. Each generator produces a double-precision, uniformly distributed random value between 0.0 and 1.0 every other clock— sufficient to maintain peak Monte Carlo simulation rates. The Mersenne Twister is favored over other methods because of its excellent properties, including a very long repetition period ($\sim 2^{19,000}$ values). Sobol quasi-random sequences for numerical integration are also supported.

Random sequence generation is performed by accessing a pre-calculated sequence of values from a table in memory. The Convey FAP provides over 1000 unique sequences (dimensions) by using a different main memory table per dimension—in fact, the number of supported dimensions is limited only by the amount of memory devoted to the tables. (Each Convey HC-1 node supports up to 128 GB of memory).

EASY TO USE, EASY TO OWN

The Convey HC-1 is easy to incorporate into your datacenter and your workflow. Because it is based on a commodity Linux-64 operating system, it clusters just like other off-the-shelf servers. Plus, third-party middleware like libraries and job schedulers will run natively on the HC-1's x86 multi-core processor.

The Convey HC-1 also helps you "go green." Because it provides vastly more performance per watt, a single rack of Convey HC-1 servers can replace multiple racks of conventional servers, substantially reducing power requirements. Reduced power shrinks utility bills, decreases floor space, and lowers the chances of hardware failure.

Convey's innovative hybrid-core computer system marries the 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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