World45

High Performance Computing on
Multi-core and CMT Systems

General information on CMT and Multi-core computing

The paradigm shift

In recent years technological advances and limitations shifted and re-shaped the IT and Telecommunication landscape. Due to physical limitations (such as speed of light, heat dissipation, noise) the ever growing clock speeds of specialised and general purpose computing processors stopped increasing. It became impractical to develop CPUs with faster clock speeds. What continues to grow however is the CPU manufacturers' ability to fit more transistors onto a single dice of silicone – to fit more onto a single dice. Such on-chip integration offers huge performance and costs benefits. The way to achieve a better computing performance lies in the strengths of parallel processing and pipeline matrix.

For a software system, the key is to be able to fully utilise all the resources packed onto a single chip. Instead of faster clock speeds software systems are given an ever growing amount of cache and processing cores. **Simply, more is being packed onto a single dice.**

Some manufacturers also support hardware multi-threading. Sun's Niagara CPU line is an example of a leading CMT solution. Sun's UltraSPARC T1 CPU offers 8 cores with 4 threads each, packet onto a single 80W silicone die.

The changing hardware technologies are unavoidably driving a change in the software industry. The benefits and scalability of multi-core and chip multi-threading (CMT) systems **change the way we think about software.** It opens new possibilities and also new challenges for software developers. This is exactly where World45 fits in.

To take a full advantage of the new, highly parallel hardware model, software must be specially designed and optimised. In such highly parallel environments traditional software modules will perform poorly.

Because individual cores tend to have relatively slow clock-speeds, such traditional applications may sometimes perform unacceptably slow. **Special programming techniques must be used that take advantage of the underlying hardware system.** Various optimisation strategies must also be used – the hardware offers various pipeline possibilities and performance benefits that need to be carefully crafted and tested. **CMT and multi-core systems can boost performance of the specialised software modules beyond the reach of traditional systems. The benefits of the shift toward CMT and multi-core systems are most noticeably: cost effectiveness and the ability to scale easily.**

World45 Ltd

- World45 specialises in high-performance computing and networking software for mid- and high-end servers.
- Provides dedicated high-throughput offload engines that take full advantage of the performance benefits multi-core and CMT technologies can offer.
- With its strong research and development capabilities associated with the University of Otago in Dunedin, New Zealand, World45 is able to tackle advanced issues that face providers and users of these new emerging technologies.
- World45 can identify, analyse and develop specialised offload modules that work on bare CMT hardware and take advantage of its parallel scalability and throughput capabilities. The team can analyse a number of performance metrics and employ various specialised optimisation techniques, such as pipeline matrices and parallelisation. The company mission is to deliver highly-scalable, fast and flexible answers to first tier customers on their volume and mission critical issues.
- World45 is currently working in close collaboration with Sun Microsystems of Santa Clara, California developing custom high-performance network solutions in the area of generic TCP/IP stack and specialised RDMA (Remote Direct Memory Access) protocols.

The Company

- World45 is a privately owned start up, operating since 2006, backed by dGV, a New Zealand venture capital firm. It has been exporting since then.
- World45 is based at the Centre for Innovation, University of Otago, Dunedin, New Zealand. In March 2006, World45 did its first public industry presentation, at the Multi-core conference in Santa Clara, California, US with a paper of Dr Zhiyi Huang on View-Oriented Parallel Programming for multi-core systems (available on our website)
- World45 staff comprises software developers plus research leaders, supported by a team of associate scientists and senior consultants

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