IBM'S LATEST SUPERCOMPUTER WILL BE 500 TIMES FASTER THAN ITS CLOSEST RIVAL.

Blue Gene genie

THE LAST TIME *FUTURES* looked at supercomputers, a then top-of-the-range home PC had a 200MHz processor with 32MB of memory and a 2GB hard disk. Three years later, PCs have moved on a bit and so has the supercomputer world.

It's a bit like trying to measure a piece of string, but, according to a list of the world's top 500 fastest computers (www.top500.org), the current fastest machine is a monster called ASCI Red. Part of the US Department of Energy's Accelerated Strategic Computing Initiative at the Sandia National Laboratories in Albuquerque, New Mexico, (www.sandia.gov/ASCI), Red is an Intel machine with more than 9,000 processors. It performs at two teraflops – two million-million arithmetic operations per second – and runs simulations of nuclear weapons.

Number two on the top 500 list is ASCI Blue, an IBM machine at the Lawrence Livermore National Laboratory, with nearly 6,000 processors. But IBM won't be in second place for long, with the announcement of its new supercomputing project, Blue Gene, which is set to be the most powerful computer ever – 500 times faster than ASCI Red.

IBM has a track record of building impressive machines. A couple of years ago, its Deep Blue machine famously beat world chess champion Garry Kasparov (www.research.ibm.com/deepblue). Blue Gene will be 1,000 times as powerful as Deep Blue, making it two million times the power of today's top-spec PC.

To build such a revolutionary machine, IBM researchers have devised a computer architecture called Simple, Many and Self-Healing, or SMASH for short. SMASH relies on an established processor design used in the RS/6000 series of machines (www.rs6000.ibm.com), with a very small Risc instruction set – there are only 57 instructions that the processor can run. Each Blue Gene chip will have 32 RS/6000 processors on board and there will be 64 chips on each of the machine's two-foot square motherboards. There will be a stack of eight motherboards in a vertical tower and a total of 64 towers. The figures are amazing – each motherboard hosts 2,048 processors, making a total of over a million.

The operating system will be a flavour of Unix and the machine will be able to support over eight million simultaneously parallel 'threads' of computation. The $100m machine will occupy 160 square feet of floor space at IBM's Watson Laboratories in Yorktown Heights, New York. It should be ready by 2005.

But what's all the computing power for? Unlike many of the world's supercomputers, Blue Gene won't be used for military or intelligence purposes. Its first application will be molecular biology.

One of the Holy Grails of contemporary scientific research is to understand how the proteins in our cells fold up into complex 3D shapes. A protein is a long, linked chain of amino acid molecules and the links allow the protein to adopt a shape which determines its function in the cell. A number of diseases, such as cystic fibrosis and Alzheimers, have their origins in anomalously folded proteins. Improved knowledge of how proteins fold could lead to the development of new drugs and a better understanding of how diseases attack cells.

Dr Paul Horn, senior vice-president of IBM Research, has a grand vision of the ultimate application of Blue Gene's protein-folding simulations. 'One day, you'll walk into a doctor's office and have a computer analyse a tissue sample,' he says, 'and the machine will instantly prescribe a treatment best suited to your specific illness and genetic make-up.'

Didn't Doctor McCoy have one of those?

TOBY HOWARD

Unlike ASCI Red, which is used to run detailed simulations of nuclear weapons, Blue Gene will be used for molecular research

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