Chip's cheapness and flexibility make it a winner

The OpenRISC 1200 may be slow, but the technology involved in it is accessible to all, writes **Danny O'Brien**

By the standards of the glossy ads in Silicon Valley chip catalogues, the OpenRISC 1200 System-on-A-Chip is a bit of a clunker - and not just in its unwieldy name.

While it was marvel to see a whole desktop PC shrunk onto a single chip a decade or so ago, these days such SoCs are two-a-penny.

They sit in everything from Internet routers to satellite decoders. The OpenRISC 1200 though, looks like it stayed sitting in the 1990s. It runs at a measly 160Mhz - a tenth of the speed of the most mundane desktop computer, and barely comparable to its fellow SoCs. It lacks simple, modern ports. And it's the new boy on a block dominated by giants like Intel and Motorola.

Yet the OpenRISC 1200 SoC has been drawing crowds of curious engineers wherever it has been demonstrated this week. Its slow, clumsy microprocessor heart is being picked up for use by projects from the Far East, to Sweden and here in California. The reason is no secret. It's that the OpenRISC 1200 has no secrets.

Everything about the OpenRISC 1200 is known and published on the Net. The instructions on how to create the chip are freely available. Any manufacturer with the facilities could make the same chip.

The OpenRISC 1200 is not owned by Intel or Motorola. In most of the senses of property, it has no owner. It has no industry secrets, and it has no lawyers enforcing careful contracts. You can do what you want with it, and never have to pay anyone a license. Not even its hordes of amateur inventors.

Just as an Internet community of programmers constructed open source software like Linux, some hardware designers are now creating "free hardware" in their spare time. The OR1200 started life as one of these experiments.

These experiments were originally designed more for education than profit: practice than practicality. But that's not to say that they don't work. Dabblers in hardware hacking may not have had access to chip factories, but the cost of creating one-off chips for their own use has dropped to the point that hobbyists can create their own one-off prototype microchips.

Those interested in chip making buy FPGA (Field Programmable Gate Array) prototyping boards for a few hundred dollars.

FPGA's are like Lego kits, toys filled with the microscopic elements that make up a modern microelectronics. They look like a normal chip, but their contents can be rewired at a whim. These enthusiasts are creating custom chips, toying with them, then re-using the parts to create another plaything.

Chips designs implemented in FPGAs can't be as fast or as complex as professionally manufactured chips. But their designs can be transferred to those normal manufacturing techniques with very few changes. And they're a lot less expensive to experiment with.

It's as though you could mock up a rocket ship in Lego, and then send it someone at Lockheed Martin to manufacture.

Out of that experimentation has come a rash of usable chip designs, including the the OpenRISC 1200 - a complete implementation of a 32-bit general purpose microprocessor, the most complex chip in any computer.

Treacly slow on FPGA, and not much faster when recreated in traditional silicon, OpenRISC nonetheless had enough functionality to attract the interest of Flextronics, a large Silicon Valley contract manufacturer. Now they're demonstrating it, embedded in their own system board, to their many clients in the world of embedded computers.

But why would a commercial company like Flextronics - whose contracts include manufacturing Microsoft's XBox game console and Cisco's thousand dollar routers - take an interest in developing a hobby product like this?

Because their customers are. In California, a company designing a chip that can work out its position by triangulating signals from nearby TV transmitters uses the OpenRISC; a voice-recognition company in Sweden is basing their product on the OpenRISC.

More are in the pipeline. And they need someone to make their chips for them.

Partly, these clients are interested because of the OpenRISC's low per unit price thanks to no licence fees to pay (although embedded chips are hardly expensive, every cent can count on mass produced electronics).

But at this early stage it's because these companies want to fiddle and tweak and optimise their central microprocessor as much as those enthusiasts do.

The attraction of knowing every atom of a chip design is very tempting when you're a microelectronics designer yourself.

It means you won't be tripped up by bugs or oddities in someone else's design (you can fix it yourself, if need be). And if you have a strange use for a standard chip, the advantages of reaching into its very heart and reconfiguring it for your own needs is very tempting.

It's the creative temptation that drove those enthusiasts to meddle with their lego kits, but it's also a very practical urge if you're trying to eke the best design for your own commercial project.

But it's not something you can do with the secret designs at the heart of an Intel or Motorola processor. Their secrets remain locked in trademarked, patented and lawyered-up silicon. There's a limit to how much fiddling you can do with a locked-tight box.

But if you need a custom chip job, the OpenRISC is as pliant as any lego set.

On price and features, the OpenRISC is not yet even in the same decade as its competitors. But while open chip cores are clunky in the current market, its cheapness and flexibility means that the OpenRISC - and its fellow free designs - may be useful for brand new applications, which until now could not afford the licenses and restrictions of proprietary hardware.

In those markets, it will have no competition. And with plenty of designers - both paid and unpaid - constantly improving it, plenty of time to establish its own, leisurely yet magnanimous, march of progress.