As the education sector looks for cost-effective solutions

Has the launch by **Intel** of its Atom chip made it viable for every **infant** & **junior** school to secure **quality ICT**?

As journalists are released from training into the real world, they undergo one final transformation. Their warm blood is replaced by a cold cocktail of scepticism and cynicism. As devout sceptics, they must take nothing at face value; leave no claims unchecked in their pursuit of the truth. And they hope that the cynicism coursing through their veins will help them seek out false motives and hidden agendas even where none might exist.
Being told that Intel Corporation has trained over 5 million teachers worldwide in the use of technology in a $1 billion programme over the past five years should be enough to sharpen a forest of shorthand pencils – or whatever the equivalent might be in the days of tape recorded interviews and word processing. The actual numbers involved are beyond question, as the governments of countries whose teacher training programmes have received assistance from Intel are more than happy to confirm.

The launch of the Atom in April 2008 has huge implications for education. The Classmate PC specification which takes advantage of its small size, low cost and low power consumption is potentially the most significant advance in computing for education for a decade. We separate the facts from the marketing hype.

But why should one of the largest IT companies on the planet want to spend a king's ransom of its stakeholders' funds on teacher training projects in remote parts of Africa, for example? In terms of potential sales of its processor chips, there are probably more effective ways of raising the company's brand profile. It would no doubt be easier to justify rolling out such programmes in the more economically developed countries of Western Europe – it has already done that - if extra profit on the bottom line were the sole criterion.

The cynics who are keen to show that teachers' loyalty to the vendor has been 'bought' so that they will recommend its products later in their careers are disarmed when the company's executives readily cite enlightened self-interest as a motivation. But as Gordon Graylish - vice president of Intel Europe, Middle East and Africa observed, its focus on education and training is very much a long term commitment, with a payback – such as it might be – ten or fifteen years down the line.

Assessing the impact of Atom

It is relevant to consider the potential impact on Intel's education 'space' of the launch of its Atom microprocessor in April 2008. The Classmate PC specification which takes advantage of the Atom's small size, low cost and heavily reduced power consumption is potentially the most significant advance in computing for education for a decade.

Introducing a new chip set to the marketplace is something that Intel has done with amazing regularity over the past 30 years. Each new generation has offered to move home and business computing up a notch, through higher processor speeds and greater memory capacity.

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Justifying the investment

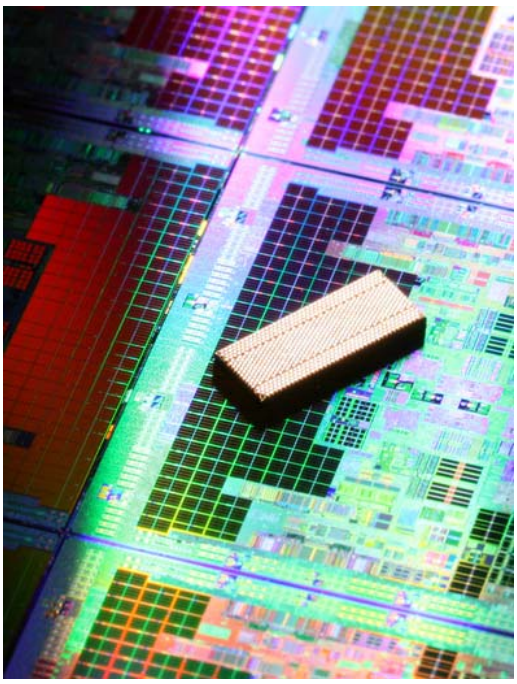
With a well-oiled Intel development machine producing ever more powerful chip sets, the question must be why the company has invested in such a radically different piece of technology as the Atom.

Its origins appear to date from around 1999, when the company looked carefully at the implication of Moore's Law.

A co-founder of Intel back in the 1950s, Gordon E Moore had demonstrated a decade later that the power of integrated processors was doubling every 18 months, while its cost in the marketplace halved.

Almost 40 years after that empirical connection had been established, Intel was facing the logistical problem of producing the next generation of processors. Was it still

An Intel manufacturing technician uses a scanner to start the first 45nm production batch of 300mm wafers at Intel's first high-volume 45nm chip factory in Chandler, Arizona.



Back in 1999, when Intel was considering the way forward for its microprocessor designs, energy consumption was becoming a matter of some concern to the IT sector, but not on the scale it has reached today. Not only is it now unacceptable to develop technology which draws down excessive amounts of power, but that higher consumption reduces the mobility of devices which employ the increasingly sophisticated microprocessors.

economically viable to sustain the principle of Moore's Law when the underlying costs of each increment in computing power were rising exponentially?

Gordon Graylish outlined some of the issues that faced the developers. Higher performance within a given semiconductor architecture is achieved only when the distances travelled by electrons through a microprocessor are reduced: the gap today is as small as 7 or 8 *atoms* between 'tracks'.

"At that scale, there are major problems around leakage current, which means that the electricity running through the semiconductor can hit a 'spare' atom and bounce off its path, only to emerge as wasted heat that has to be dissipated. We had been pushing the existing architecture very hard to increase its operating speed in megahertz. The extra performance was being achieved, therefore, only at a huge increase in the energy needed to power it."

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Energy consumption as a factor

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According to the Intel executive, a line had to be drawn in the sand. "Whatever we did from that point had to be radically different if improved microprocessors were to be viable. We spent time on a new technology which can best be described as the 'High-k dielectric Hafnium-based metal gate transistor', which is the biggest advance in 40 years.

"It means that we will see Moore's Law maintained, but it has further-reaching implications. The development in processor design has proved incredibly successful, and the majority of all the microprocessors shipped in 2008 are based on that technology –

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described as '45 nanometer' due to a critical internal dimension. That includes the Atom, which is arguably the most advanced processor technology in the world."

Targeting a market sector

What appears to have led Intel to the Atom was a recognition that the company could deliver a solution which met the requirements of a specific class of use. Whatever came out of the design process had to be small in size and low in power consumption.

Atom was launched with a 90% reduction in power consumption and an 80% reduction in size relative to the previous generation of microprocessors. It clearly had a marketplace in a line of small devices where space and power supplies would be a problem.

Gordon Graylish was careful to position the new chip. "It is not as powerful as our current Core processor but we felt that it is consistent to have multiple processors in the range so long as they are 100% mutually compatible. The Atom is therefore a well-designed device that has been tuned to market requirements."

With a demand for long battery life and small footprint, a new range of devices from an array of manufacturers offering mobile PC capabilities was a product set waiting for the Atom to happen. Intel prefers to describe these systems as 'netbooks' on the grounds that they represent a distinct tier in the information marketplace: referring to them as 'sub-notebooks', in contrast, could imply just a cut-down or degraded version of an existing product set.

Semantics aside, an Atom-based netbook would be ideally suited to run the kind of application found in most junior schools. The demand there is for a system that is cheap to purchase and can run a full spread of educational software. They have long battery life (or draw low power when connected to the mains) and are physically small, but would be unsuitable for resource-hungry applications like high definition video or media editing; neither of which figures prominently in the junior school curriculum."

As the Atom processor is reaching system manufacturers at a fraction of the price they would have to pay for Intel's Core processors and those of its competitors, machines based on the Atom are being positioned squarely at the entry level of the school marketplace.

Price, size and power consumption make the Atom a logical choice for embedding into other technologies such as industrial controls, where developers need a device that is also easy to programme. Manufacturers have already introduced technologies based on the Atom for the consumer electronics space, for example, where consumers now want to buy devices cheaply for integrating home TV and the Internet.

Highly compatible

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Any application capable of running on an Atom-based netbook could be accommodated on a school's existing PC equipment. The ability to have the same software available across the full range of ICT systems within a school reflects the tendency today to provide a mixture of 'personal' computing where children might be assigned a machine to use around the school (and at home), and computing 'laboratories' where classes go for ICT lessons on their timetable.

Above: The ASI Ability Office range is assessed on page 76. We found that this product set has a footprint small enough to run on the Intel Atom and across a complete range of computers used in schools.

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In developing the Atom, Intel was conscious of the need for compatibility with its Core processors, as Mr Graylish has explained. In practice, that meant being able to support both Linux and the most popular Microsoft operating system, Windows XP.

While the Atom can physically run Microsoft Vista, most vendors are expected to be offering only Microsoft XT as this segment of the market has little need for many of the features found in Vista. The 'overhead' saved in this way provides much needed additional resources for applications.

Any limits on applications?

Does the more limited processing power of the Atom mean that machines based on this chip cannot support applications such as word processing, spreadsheets and presentation software? If that were the case, the world of Atom could be smaller than Intel envisaged.

To evaluate this particular aspect of the netbook marketplace – and the evolving requirements of the education sector as a whole - the Informed Executive has been tracking down software which can complement the new microprocessor's features while allowing it to run a fully-featured suite of administrative software. On page 76, we look more closely at one such product set which include all the usual office-style applications, along with accounts, business planning and staff files.

In the vitally important matter of delivering Atom-based netbooks to the education market, Intel has to ensure that purchasers fully understand the concept of the 'Classmate PC' and how this brand relates to the steady flow of netbooks coming on to the market.

Gordon Graylish explained that the Intel Atom has already been taken up by more than 40 different manufacturers who are using the processor as the engine-room of a compact, highly personalised mobile computer. "The specification of the machines they create is entirely their affair: they are simply customers for our output of Atoms and will brand the devices as they see fit. They can use the Intel Atom logo to increase their marketing potential, however."

Clarity needed over Classmate brand

Whatever the systems developed by the 40+ manufacturers might claim to be, they cannot be described as Classmate PCs, however, unless they meet Intel's proprietary specification for a lightweight, energy-efficient mobile computer.

It would be fair to say, however, that a manufacturer which does build such a product would be keen to leverage from the name. It is important, therefore, that anyone purchasing a netbook can be clear about what they are buying.

Without the definition of the Classmate PC being clearly drawn in this way, Intel could

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find itself becoming another Hoover, with the Classmate PC identity applied incorrectly. It is not unusual to hear customers in an electrical showroom asking for an 'Electrolux Hoover' or a 'Panasonic Hoover', while the Hoover brand name itself entered the dictionary decades ago as a verb.

Entry-level system for schools

The Classmate PC specification evolved alongside that of the Atom chipset itself, when Intel had first seen the new processor as a perfect workhorse for machines being sold into emerging markets.

As Gordon Graylish observed, the same spec appeared to meet the requirements for a new entry-level system right across world markets. "Children have great eyes and small hands, which meant that we could design a system that has a smaller keyboard and screen than a laptop. No less important, the device has to be rugged, have a scratchproof screen and be capable of incorporating features such as cameras.

"What emerged from our extensive analysis was a *reference* design, which we called the Classmate PC. Manufacturers who have adopted that design spec know that it is immediately obvious to a government or local authority what the machine is, and what it is supposed to do. The business model that we have found working in a number of instances to date is where a 'white label' manufacturer builds a netbook to the Classmate PC spec.

"It is then branded by specialist companies with experience of selling into the education market."

Purpose-built - not 'cut down'

Whether teaching establishments commit to an implementation of the Classroom PC or purchase one of the independently specified netbooks is almost immaterial (so long as the distinction is well drawn and understood).

Whatever their decision, they will be working in the familiar territory of Linux and Microsoft Windows, a small footprint, low power consumption and software compatibility.

Most important, taking the Atom route is not pursuing an inferior or 'cut-down' route into ICT for the education sector.

In terms of the technology's performance, size and cost, it represents probably the most cost-effective and investment-protecting ICT solution available. §

Above left: The second generation of Classmate PCs has a touchscreen option which increases its appeal to the youngest age group in the educational system.

Investing in computers based on the Intel Atom route is not pursuing an inferior or 'cut-down' route into ICT for the education sector. In terms of the technology's performance, size and cost, it represents probably the most cost-effective and investment-protecting solution available for junior schools today.