

From planet-wide communications to **global domination**, Brian Clegg plots fibre-optics' future.

Let there be light



There are two big drivers for the frantic pace of IT development: games players – demanding photo-realistic graphics – and businesses with their ever-growing databases (actually there are also the computer manufacturers, enticing us to

buy the latest product and fill their pockets, but let's ignore them). As we demand more and more throughput to handle this flood of information, the poor old electrons that zip around carrying data inside computers are groaning under the strain.

Perhaps it's time to hand over to something more lightweight. In fact, to light itself. The idea of computing with light is not new. Some time ago it was suggested that tired transistors could be replaced by faster optical devices, but the idea proved to be beyond current technology and nothing came of it. Elsewhere, though, light is taking over. In fibre-optic cables around the world, light has become the transmission medium for telephone calls and the Internet. The curiosity that a

to a peripheral or nearby computer. Free light is much less fussy. You can pass two beams through each other without problems, there's nothing to stretch and tangle.

So, with light in mind, let's revisit those business databases. Mass storage technologies suffer from bottlenecks. If you really want to get value out of your huge customer database (or whatever), you need to sift vast quantities of data with immense speed. One answer to this is to hold the whole database in memory, assuming memory prices collapse enough that the thought of terabytes of data sitting ready for access is practical. Another approach is holographic storage, keeping oodles of information on a compact crystal of which Mr Spock would be proud. Already viable in the labs, holographic storage should be with us very soon now. But whichever approach you take, there's a problem when you try to use the data, because you just can't get enough pins into a chip.

Memory databases or holographic stores can dump out an immense quantity of information at once, but there isn't a lot of point unless you can do something with it. If, instead of a series of pins to send the data down you could have a light array, the surface of a chip or crystal could carry millions of bits simultaneously. In fact, there's already a machine funded by NASA under development, which is intended to handle petabytes (the next step up from terabytes) of data in a second. Just to put

that into context, it's the equivalent of every book in print in the English language passing by in about a quarter of a second. Without light as transport it would be impossible to shift the data at this speed, wherever it is coming from.

While these head-spinning volumes are restricted to the specialist market, there will be repercussions for the average PC. Apart from anything else, free-space optics would make it practical to have a computer that was made up of individual components, which could automatically link into the system when you brought each of them into proximity. Do you want to add a new hard disk? Simply put it on your desk and it's part of the system. Judging by previous developments, the hardest thing will not be the technology but getting manufacturers to agree on standards and not to go it alone. Either way the light revolution is on the way.

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Victorian observed when a beam of light followed a spout of water pouring out of a tank has gone on to banish copper and electrons.

So, why not use light to connect the innards of a PC? Your processor isn't trying to send information around the world, just across a few centimetres. Inside the confines of the casing there is no need for the wasteful back-and-forth bouncing of fibre-optic's internal reflection. It's practical to send information pulsing around in a web of light. The scientists working on such computers give the technology the romantic-sounding name of free-space optics.

There are more advantages to this than just speed. Changing electrical fields in one wire have a bad habit of influencing nearby wires – it's hard to prevent cables and components from interacting in the confined PC box. And the topology of cables is limiting, especially when you want to send information outside the casing

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