4. Get even BIGGER and DISAPPEA

Even as they carve out a place in the world of e-business, the leaders – our customers – cast an eye over the horizon, searching for the next big movements. We're looking with them. And right now, we see two.

The first is called Pervasive Computing. It is the inevitable extension of the networked world – to connect not just individuals and institutions, but lots of everyday things that will contain a little embedded computing and networking capability.

The second trend is at the other end of the wire, what we call Deep Computing. It's the union of ultrafast processors with advanced algorithms and software to create very powerful systems that can attack problems and challenges previously beyond computing's reach.

For us, pinpointing the next shift is fundamental to our business. It's why we invest billions in exploratory research and technology development every year. This isn't a dreamy, speculative look ahead. We see what we are uniquely able to see – and, often, see first.

R

Bernie Meyerson
IBM Fellow and pioneer of silicon germanium

computing takes on the **mysterious**...

MEN WALKED on the moon three decades ago, but there have remained myriad challenges beyond the reach of technology - problems too expensive or too time-consuming to be practically solved with even the most powerful computers. But now that's changing. A new capability began with Deep Blue, a chess-playing supercomputer that could consider 200 million possible moves per second, coupled with analytical software so sophisticated some said it began to mimic the workings of the human mind. Today, the lessons of that chess match are helping us create a new market opportunity we call Deep Computing.

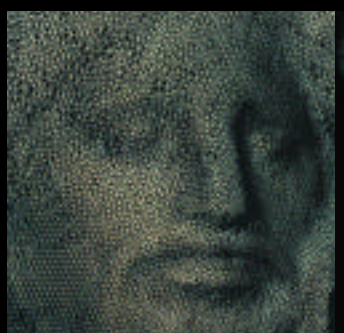
This capability is now being applied to monumental challenges - endeavors far more important than chess: modeling financial markets and weather patterns, challenges in biomedicine, data mining and genomics. In the area of pharmaceutical research, for example, Deep Computing allows researchers to reduce significantly the time required to design new drugs.

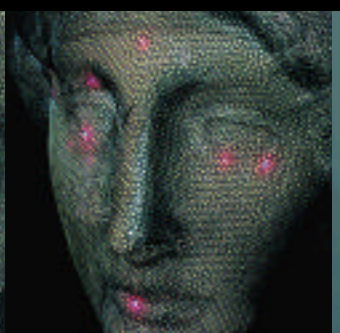
Michelangelo's second Pietà is a work of undeniable sorrow – said to be unique in its ability to move people to tears. Perhaps that dark power overcame the sculptor the day he took hammer in hand and smashed chunks out of the work he intended as his tomb monument. He was stopped by a servant. The piece was never completed, but was repaired by an undistinguished sculptor.

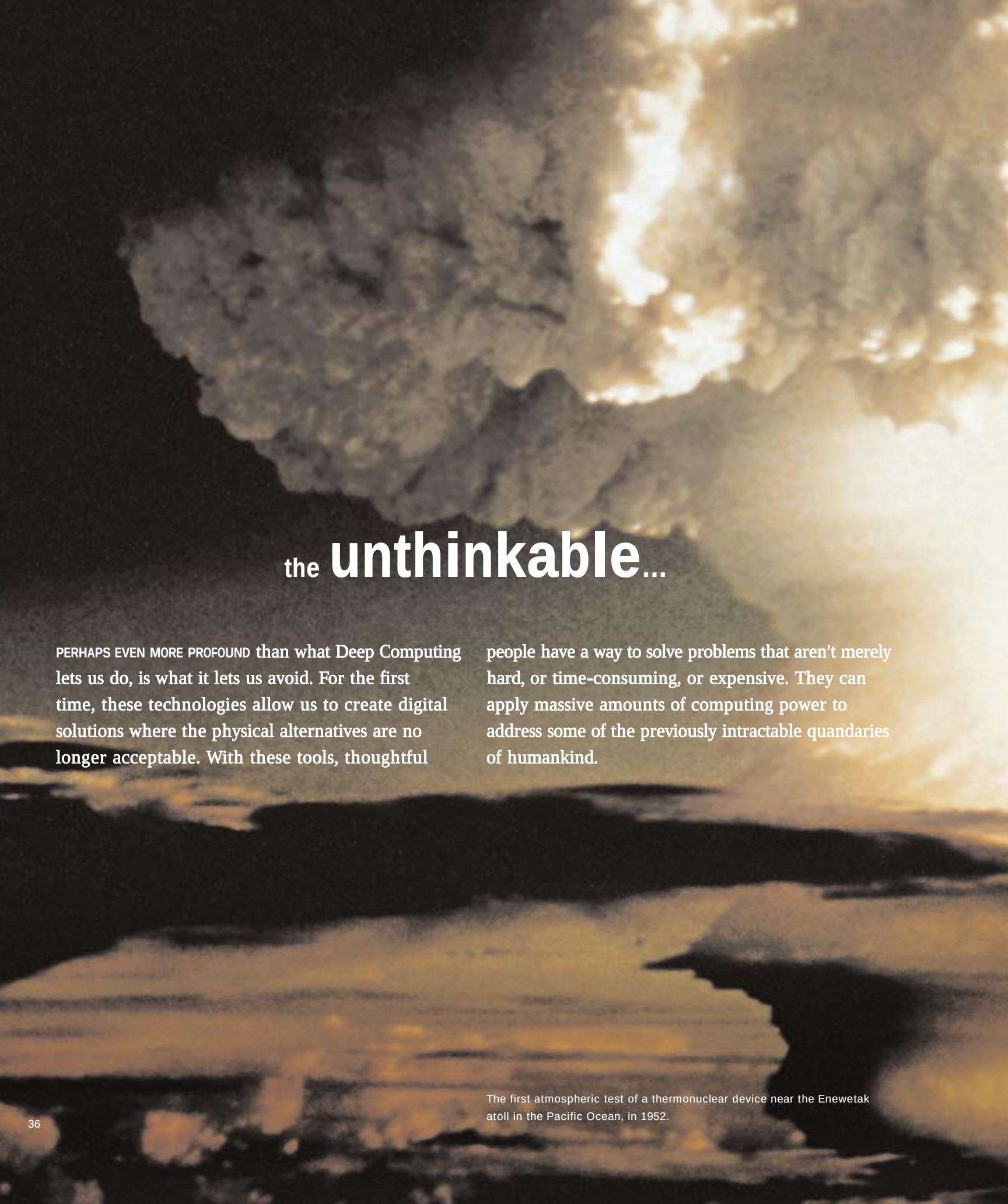
Now, IBM researchers and art historian Jack Wasserman are using Deep Computing techniques to create a near-perfect replica – a digital one – based on analysis of nearly 2 billion bits of data. They hope their work will lead to new theories about Michelangelo's concepts of proportion and dimension, and what the work looked like before pieces were reattached.

A special six-lens camera originally designed for cosmetic surgeons captures hundreds of digital mesh "shape photos." From these, a computer using a special mathematical algorithm reconstructs a wireframe model of the sculpture. Though crude, this model contains millions of points and triangles to define surface contours.

Mastering the geometric complexity of the Florentine Pietà generates new techniques for digitizing very large real-world objects. These techniques allow scholars to make computer models of objects to which they ordinarily would have no access, and to examine them in exquisite detail.







the unthinkable...

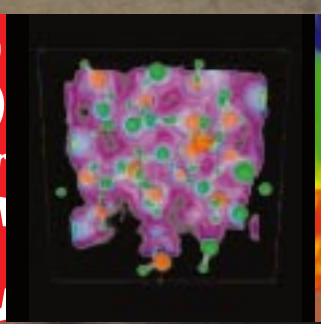
PERHAPS EVEN MORE PROFOUND than what Deep Computing lets us do, is what it lets us avoid. For the first time, these technologies allow us to create digital solutions where the physical alternatives are no longer acceptable. With these tools, thoughtful people have a way to solve problems that aren't merely hard, or time-consuming, or expensive. They can apply massive amounts of computing power to address some of the previously intractable quandaries of humankind.

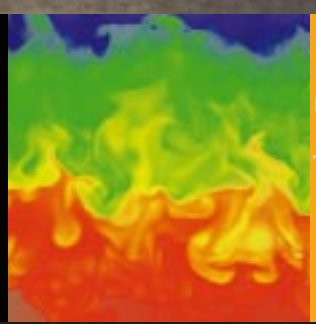
The first atmospheric test of a thermonuclear device near the Enewetak atoll in the Pacific Ocean, in 1952.

3.88

trillion calculations per

SEC





4.00

TERAFLOPS, ON THE WAY TO

100

In the fall of 1998, IBM delivered an RS/6000 SP – the world's fastest computer, twice as fast as any previously built – jointly developed with the U.S. Department of Energy's Lawrence Livermore National Laboratory.

How powerful? Capable of performing nearly 4 trillion calculations per second – more than a person with a hand calculator could perform in 63,000 years. Another way to look at it: the supercomputer known as "Blue Pacific" is 50 times faster than Deep Blue, the supercomputer that defeated chess grandmaster Garry Kasparov.

In the post-Cold War era, this is the kind of entry-level computing power the experts in charge of nuclear arsenals need. It allows them to run highly complex simulations that certify the safety, security and reliability of the stockpiles – without performing live tests.

"Before we had this technology, calculations of the complexity required for stockpile stewardship were absolutely impossible." – Dr. David Nowak, Accelerated Strategic Computing Initiative Program Leader, Lawrence Livermore National Laboratory.

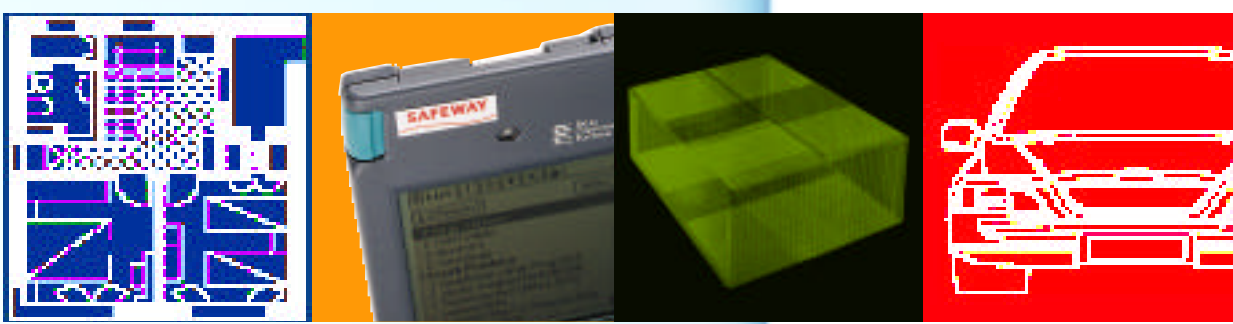
Next up: development of a follow-on RS/6000 SP for the U.S. Department of Energy to model nuclear reactions more fully. It will approach 100 trillion calculations per second – dwarfing the 4 trillion possible with Blue Pacific.

and becomes **invisible**

THE EVOLUTION of information technology is as irresistible as a force of nature. The basic elements of computing – processors, storage, memory – all grow inexorably faster, smaller and cheaper. That renders a few things pretty clear.

One is that e-business is just phase one of this networked transformation. What's next is an explosion – from a world of a million e-businesses, and a billion connected users to a trillion connected things – cars, clothes, household appliances, machine tools, each emitting a little information and all of them interwoven in the global information infrastructure.

Imagine intelligent vending machines sending regional distribution centers reports on what kind of soda is selling, what's not, even the optimal time to send a route driver to empty the coin box.



YOUR HOME

Home buyers can now move into a clean, spacious... computing device. We're working with partners in the home construction industry and with Bell Atlantic in the United States to deliver IBM Home Director, which integrates everything from Internet access to control of security and lighting systems, heating and air conditioning – all from any PC or TV screen.

YOUR GROCERIES

Even the weekly ritual of grocery shopping is being transformed. Safeway UK and IBM are piloting hand-held devices that let shoppers make up grocery lists and submit the order from home. The supermarket fills the order and has it ready for pick-up. Or shoppers can cruise store aisles scanning groceries and tracking their total. Customers like the convenience. The super-market likes the fact that high-spending families are doing more of their shopping with Safeway.

YOUR PACKAGE

Today, you can track the status of any overnight package from depot to depot. Tomorrow, parcels with embedded computing and communications capability might be tracked mile by mile, street by street and block by block, until they reach your door – and you.

YOUR CAR

We're working with automakers to prototype wireless links from the car to the Net, combined with IBM voice technology to give drivers e-mail (voice-activated), driving directions and updates on road conditions. Onboard sensors would alert drivers – and the nearest service center – if a problem were brewing. And imagine the benefits to automakers when these links beam continuous information on engine performance directly to manufacturing and product development.