

## WWW — What might be next

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formerly CERN

### I worked at CERN

I spent 30 years of my working life in different activities at CERN, the European laboratory for particle physics. A journalist recently described the scientists of CERN in this way:

*AMAZING!! Here are people who change their mind in the face of evidence!*

Apparently most people make up their minds without taking evidence into account. Dangerous.

### WWW

In 1997 the University of Chicago celebrated the 40th anniversary of the launching of Sputnik. Sputnik had prompted US president Eisenhower to spend money on basic research, in the hope of staying ahead of the USSR. The financing of the ARPANET came largely from that initiative (hence also the myth that the internet, of which the ARPANET was the biggest component, was a military development). I was invited to the 40th celebrations to give a talk about the history of the web. Physicist and Nobel Prize winner Leon Lederman was also present. At our introduction Lederman said to me:

*"It is not because CERN invented the web that they have any right to say anything about it."*

Lederman is partially right of course: the inventor does not own the future of the invention. On the other hand, they have as much right to talk about it as anyone else. Recently Tim Berners-Lee said:

*"Because we created the web we have a duty to understand it"*

That's interesting, because I pleaded from the very start for a considerate approach, sometimes in considerable disagreement with the early developers.

### Where are we now?

Before the web there were a number of systems to access distributed information, but they were mutually incompatible: they were *vertical* markets. The Web's big idea was to provide a standard of communication between the readers and the data bases they accessed: the URL addressing scheme, a common protocol (http) and format negotiation. The web is nothing if not these standards. It's not any software that came from CERN, nor a lot of data on servers. The web is a *set of standards*, developed by a consortium called W3C and run by Tim Berners-Lee.

Arguably the most crucial part of www is the URL: the name space in which all documents can be identified, whether they exist, are generated on the fly, or are still to be dreamed up.

The final structure of the web was developed during the short period from 1990 to 1997, over which interesting phenomena appeared. There was a lot of pre-history of course, but there was also much disbelief, incomprehension, stupidity and groping in the dark. We had to fight ingrained habits, keep going, collaborate and make compromises.

The lessons learned from this first massive incursion into the digital realm on the scale of the world population are simple:

*cooperate instead of competing, be open and remain open, lay down standards.*

## Un-Expected

From our base in CERN I predicted a number of developments but not others:

- expected: Spread, speed, universality
- unexpected: search engines keep working (they are centralised, therefore do not scale well)
- expected: slowness of government and industry.
- unexpected: the ingenuity of the users (blogs, rings, groups, ...)
- expected: the vicious triangle of reader-author-advertiser; abuses; phishing, ...
- unexpected: collaborative structures such as the Wikipedia, displacement of administration (e-banking).
- unexpected: we still have no micro-payments and hence no information market that is as simple and transparent as the Minitel services in France are.

## Speed

We lost about 4 years because politicians were slow in understanding. Journalists were slow. Industry was greedy and did not respect the standards. Things could have moved better.

Given the industrial capacity in 1830, the railways developed a lot faster relatively speaking than the web did in 1990. The main reason for this slow uptake is that the web was the first purely intellectual item: you can see trains and TV sets and they are simple to understand, but you cannot see the internet and its complexities.

## Understanding

To illustrate how difficult it is still today for us to understand this type of brain-related activity: Tim Berners-Lee was knighted by the Queen of Great Britain in 2004, fourteen years after inventing the web. In contrast, Ellen MacArthur who won an around the world sailing race, was nominated for a knighthood *before* she even crossed the finish.

Sailing can be grasped, web-building cannot.

## Everyday communication

The public perception that communication is moving fast and getting better is largely false. Some examples:

I often get lengthy e-mails, still written in the style of paper-based letters, far too long and ineffective.

Many people print their e-mail, which is a total waste, especially if you also delete the electronic version because then you immediately lose the ability to search by computer.

A recent study shows that children brought up on visual "communication", especially in disfavoured families, lack adequate vocabulary to formulate ideas, even to themselves. This is not only linked to poor performance in school, but also to violence as a result of the inability to express their problems verbally in an articulate way.

There is a noticeable inflation in the volume of bits and bytes that are "communicated". For reference: the four gospels of the New Testament are on average 120kB each, Hamlet by Shakespeare is 206kB but a single image can easily be *ten times* that size! I'm not protesting against size per se: I'm concerned about the *ratio* of useful information to number of megabits travelling the wires and getting into our eyes.

"Communication" becomes much more visual, to a ridiculous extent: I receive texts in the form of scanned images. This not only increases traffic, but it prohibits the re-use of the information. In addition, there is time and effort wasted in making these images where a simple text would have been much better. The classic sin in e-mail today is to use a word processor to type the text of a message into a formatted file, and then attach that file to an e-mail instead of just typing the text directly into the mail's message body.

## We don't use computers

Computers are now a form of entertainment and perhaps everyman's print shop. But we certainly do not use them *to assist us* in filing or transforming information.

The classic, symptomatic sin here is sending forms by e-mail, but not providing them in a structure that permits the recipient to fill them in and sign them. The only option then is to print and use the post. Definitely not a good example of modern "communication".

## And where is Europe?

When I was worried that Europe was not picking up the internet/web technology fast enough, I was assured by my contacts at the European Commission that Europe had all the worthwhile content, and that content on the web would be our major contribution. Today however, of the 30 most visited servers 25 are in the US, 4 in China and only 1 in Europe.

## Virtualisation

More important and more worrying than traffic and formats is the trend towards *virtual living*.

People retire from the real world into the virtual world of the net.

On-line virtual 3D worlds in which people can build their own imaginary domains draw increasing numbers of "players". Real crimes already take place in these games. Objects in the simulated worlds are sold for real money.

The real world is imperfect and its laws cannot be changed. The simulated world is much more attractive.

Do people still care about the real world, the environment, conditions in developing countries etc., when the virtual world is free of nasty physical problems?

## Web 2.0

Undeniably there is a big movement afoot: people participate in new societies on the net. This is both driven by and drives the development of "new" net and web technologies.

But Web 2.0 is not a technology, it is a set of concepts. It is all about social and political behaviour. Food for sociologists and psychiatrists.

We'll have to see how these new modes of behaviour will interact with the physical world.

## Net neutrality

A short word on the battle currently fought mainly in the US. Net neutrality to me means a separation of the powers of the internet providers and the content providers.

The problem is very much like that of the cell phones: some model phones are linked to a carrier. Would you accept to buy a car if it were linked to a brand of petrol? Why should we then accept that we would get access to certain sites only via a certain provider?

The web *solved* the problem of vertical markets, let's not re-introduce it!

Let us keep the powers separate: sites do content, ISPs do access. No mixing allowed.

## Other important issues

- Whenever something becomes digital it also becomes open. Copyright, patents and other protections that applied in the world of physical copies do not apply in the digital, networked world. The social channeling of our desires has to be thought through anew, the old fences no longer work.

- Where is the information market? Micropayment technologies have not emerged. I should be able to have an electronic purse with electronic money, whereby my computer automatically pays very small amounts (fractions of cents) for fragments of info that I look at. I should not have to worry about whether or not I have

subscribed to certain sites. At the end of the month there should be a bill just like the ones we now accept for the telephone. When I post a letter, I glue a stamp on it. The stamp is not linked to where I send it. I do not pre-pay a large sum to each recipient so I can send free letters for a year to that recipient and to them only. Why can't we do similarly for www? Sites could then live from their income and not necessarily have to rely on advertising.

- Why do people trust net-based applications? Who controls, guarantees and protects the data that I put onto servers? Many people now have all their e-mail stored on remote servers without knowing where they are and what happens to them. It will get worse with Google's service "documents and spreadsheets". Obviously there is a great advantage to sharing and accessing documents over the web, but *who polices* this?

## The Future

It's now over 40 years that scientists have been worrying about human impact on the planet. And not only scientists: industrialists ordered an in-depth study of trends as far back as the late 60's, leading to the famous "Report of the Club of Rome". In that report, published in 1971, several scenarios were proposed, many of them very negative for our planet. They were based on what was then a sophisticated model of the economy, and most simulations predicted catastrophe around the year 2050.

But nothing happened in the way of policy changes. The most striking prediction from that report was that if nothing were undertaken, then the Earth's population would grow to 6 billion by 2000.

The real problem is not Web2.0, terrorism, technology, underdevelopment or global warming.

The real problem is *too many people* on the planet.

Not only have we *tripled* the population in just 50 years, we have also *multiplied the range of action* of each individual. That means a much bigger impact than just the effect of more people.

## Capacity of Brains

Science has progressed beyond what the average person can grasp. To understand physics, you must know mathematics: language is dearly insufficient. This makes it impossible to explain some current knowledge to the lay public. Concepts communicated by today's scientists sound like those of religious groups: there is little possibility to check their truth (relativity, quantum mechanics), so even the educated layman must accept much on faith. Arthur Clarke in 1973 said:

*Any sufficiently advanced technology is indistinguishable from magic*

Even youngsters understand this intuitively: popular music often reflects a sense of disorientation and incomprehension in its lyrics.

Our brain evolved for hunting in packs. It is good at social interaction in small hierarchies and manipulating simple tools. It is not good at precise reasoning and not good at abstraction. It is slow in taking up knowledge and can't handle much at once.

Our brains are too small for the current volume of data-information-knowledge-wisdom.

The average brain is incapable of understanding the new knowledge, whether in biology, physics or informatics. People can have a gut feeling of disliking genetically modified crops, but they cannot acquire an *informed opinion* unless they can *understand the science* behind the issues. Even many scientists gathering new knowledge don't see the implications that using this knowledge may have.

## Artificial Intelligence

The web will get some autonomy in decision making with the introduction of semantics. The goal is to make it as easy for machines to understand web pages as for humans. Is this the start of

an Artificial Intelligence (AI)?

The coming singularity Ray Kurzweil talks about will likely be the point at which the AI ignites. AI as a discipline has made almost no progress since its inception in the early 60's, due to lack of computing power and sensing systems. Today simulation of meaningful parts of the brain are attempted, even though they are small parts on very powerful computers.

Progress towards an Artificial Intelligence is fast: in the yearly DARPA autonomous vehicle race *no machine* finished in 2004, but *all* did in 2005. AI is finally getting the computing power it needed for lift-off. There are already groups studying the ethics of robots, responsibility, liability etc.

Edward Fredkin has this history of the universe:

*There are three great events in history.*

*One: the creation of the universe.*

*Two: the appearance of life.*

*The third one, which I think is equal in importance, is the appearance of artificial intelligence. This is a form of life that is very different, and that has possibilities for intellectual achievement that are hard for us to imagine.*

To him the appearance of intelligence is the last phase of biological life and *irrelevant* as long as it permits the transition to artificial intelligence.

My personal definition of an AI is:

*An AI is an entity capable of redesigning its own cognitive processes.*

That implies a rapid progression to ever smarter "machines". We will not understand their motives. Even the concept "motive" is very human-related and may not apply. We may not even know that there is an Artificial Intelligence when it comes into being.

I will go further than Fredkin: biological evolution had competition as side effect. AIs would not have to compete, would

be cooperative and amalgamate into a single AI. I believe there is room for only one AI on the planet. Will it appear within our lifetimes?

### About Robert Cailliau

Robert holds degrees in engineering and computer science from the universities of Ghent (Belgium) and Michigan (USA). He has worked for CERN, the European Laboratory for High-Energy Physics since 1974, mostly on human-machine interaction. He was instrumental in the conception, development and subsequent spread of WWW from its creation at CERN in 1989, to 1995. He retired in 2007.