The Internet is hypenning... partly just hype and partly already happening

Abstract:

Is the Internet hype or happening? This article looks at areas where the Internet is mainly hype and areas where it is really happening. By putting the Internet in a historical context, it will show that it is just another small step in human history. It also gives a glimpse to the future and some of the areas that might have big changes, such as peer-to-peer network architectures.

The Internet is hypenning... partly just hype and partly already happening[1]

This article revolves around the question "is the Internet hype or happening?"

First, we'll look briefly at what the Internet is (section 1). In doing this, we'll make some large simplifications, such as in our introduction to the Internet Protocol (IP). Section 2 identifies some of the areas where the Internet is mainly hype. Section 3 goes into some of the areas where the Internet is really happening. By putting the Internet in a historical context, section 4 will show that it is just another small step in human history, while section 5 gives a glimpse of the future and some of the areas that might produce big changes in human existence. Section 6 concludes the article.

1 The Internet is just the infrastructure

Many people refer to web pages as being the "Internet"; when they go "on the Internet" these individuals send letters and chat. When we apply a stricter definition, however, the "Internet" is not the World Wide Web; the Internet is not e-mail; the Internet is not "big brother" or any single chat or browser program... The Internet is just the underlying infrastructure that enables i-services[2]. Such infrastructure has made some products and services, cost-effective.

The Internet is a public and global mass of interconnected computers and intelligent devices that share, or use, information and resources. At last count there were millions of computers and millions more nominal users.

If we fully connect eight computers directly to each other, we need 28 connections (see Figure 1); to connect thousands of computers this way would be impossible, let alone millions of computers, yet clearly this is what the Internet does. It is the Internet Protocol which makes this possible.

The Internet Protocol (IP) solved the scaling issues when interconnecting thousands of computers by introducing the concept of local networks inter-linked via routers (Figure 2). Each computer only needs to be connected to one of the routers. This connection will be its gateway to the rest of the network. Each computer has a unique identifier formed by 4 numbers, which is called an IP address (for instance 93.255.1.34 or 90.155.10.148).

[1] This article is largely based on the lecture given at the Telecommunications Society of Australia in March 2001.

[2] i-Services (Internet Services) are services provided over the Internet. They are a subset of e-services which are services that use an electronic medium.

[3] Encyclopedia Britannica considers the Internet began in 1983 [13], which would lower the number to 15 years but still higher than other technology introductions.

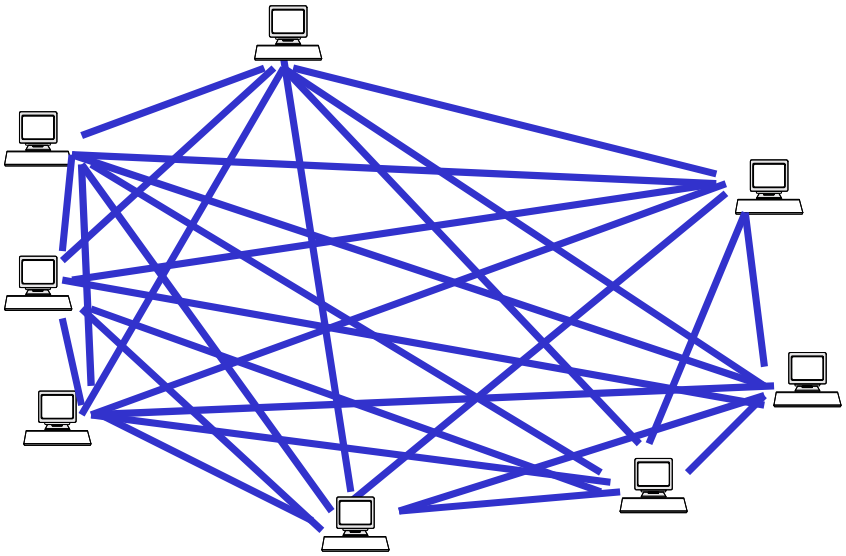

Figure 1. Network of computers

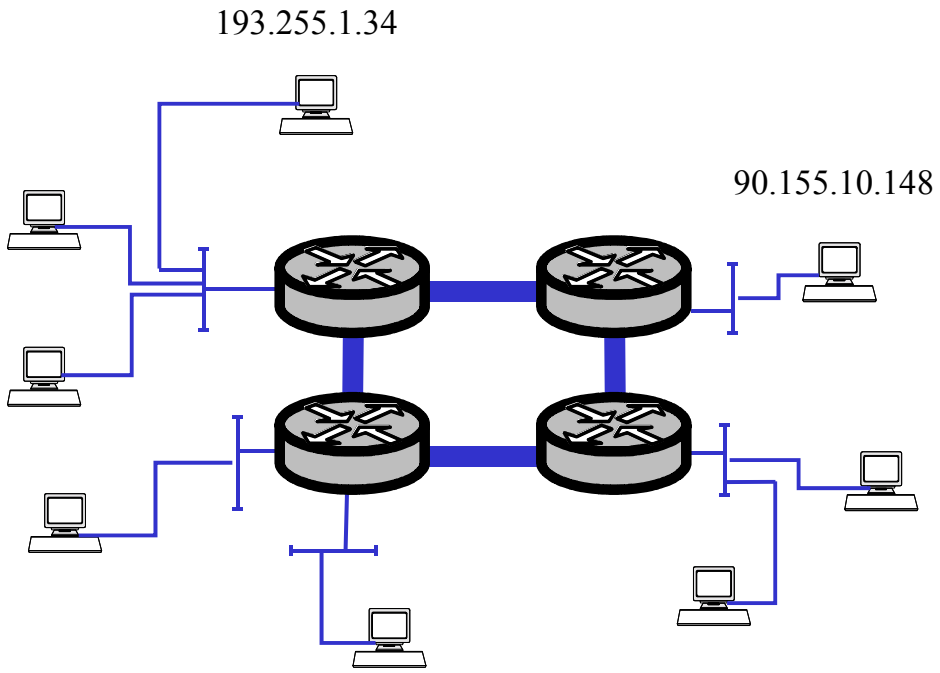

Figure 2. Internet network of computers

To send information (for example, a letter via e-mail) between two computers, the Internet Protocol does the following, once the letter is in binary form (see Figure 3):

1. Slices the letter into packets.
2. Appends a header to each packet. The header includes the IP addresses for sender (eg. 93.255.1.34) and receiver (eg. 90.155.10.148) and the packet number (order position within the file being sent).
3. Each packet with header is sent individually.

4. The routers direct each packet toward a destination via the best available path in the network at that instant. This means that all packets of the same letter might not use the same network path.

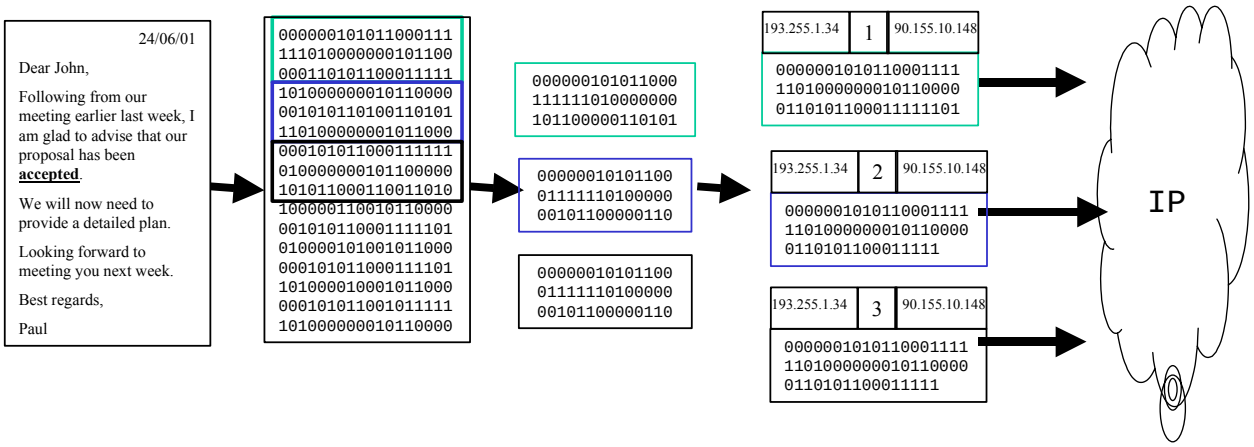

Figure 3. TCP/IP sending procedure

At the receiver's end, the Internet Protocol does the following (see Figure 4):

1. Re-orders all packets according to their packet number.
2. Strips off the header and appends all packets in the original order.
3. The original binary information is thus assembled.

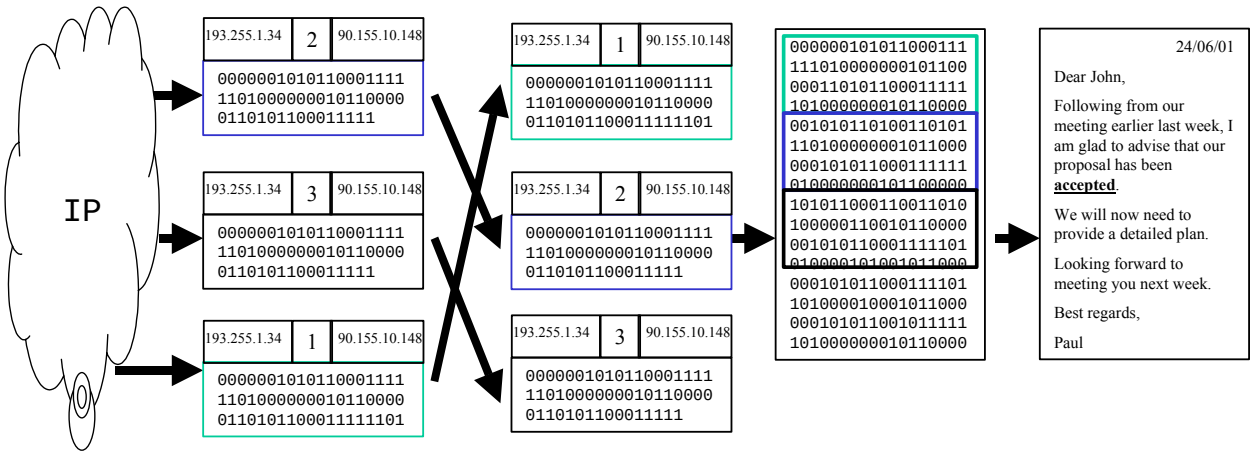

Figure 4. TCP/IP receiving procedure

Of course, the use of the Internet Protocol is not restricted to computers. Any device that is IP-enabled can send information to the Internet (or IP packets).

2 Partly the Internet revolution is just hype

2.1 The i-economy is small

We might think that the Internet economy (i-economy) is big. However, the Internet Economy indicators [36] have found that only 20% (as of June 2000) of the total economy is related to the Internet (routers sales, web design, network construction, etc, etc) or business done via the Internet (eg. purchases via the web).

This figure (20%) might seem high to some. However, the part of the total economy related to the motor engine is much higher. Any purchases are related to the motor engine because a car or truck is used for its delivery and transport.

Internet economy Indicators also found that only 28% of Internet jobs are IT jobs and engineering jobs while 33% are sales and marketing.

2.2 The Internet revolution has been slow

It is often believed that the Internet has been the fastest-ever revolution in history. We are told that only 5 years were necessary for the Internet to have ten million users world-wide and we are pointed to the 22 years it took for the fax machine to achieve the same number of users world-wide [6].

However, if we consider 1974 (year of the TCP/IP specification) as the Internet's birth year, then 24 years were necessary to achieve the ten million users[3] (see Figure 5).

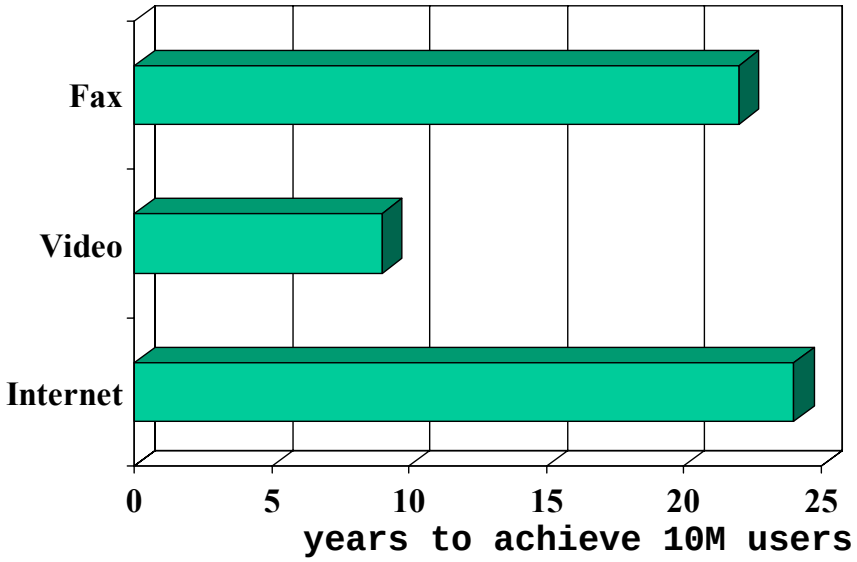

Figure 5. Years to achieve 10 million users world-wide (data for fax and video from [6])

2.3 The new economy needs the old economy

2.3.1 Old concept of strategy is needed

There's been a lot of press coverage for the so-called "new economy" (or networked economy) which is supposed to turn upside-down the rules of the so-called "old economy" (or industrial economy).

Fortunately, articles in prestigious journals claim the need for strategy (in its traditional meaning) for Internet business [21]. This essentially means business needs to use "new economy" items in old fashioned ways: with specific business purpose and value in mind.

2.3.2 Electricity is needed

Electricity is an essential requirement for the Internet. The electricity crises in California at the beginning of 2001 had a big impact on data centre operations.

The need for electricity will increase as the Internet use increases. It has been estimated that electricity consumption per square metre of data centre will increase yearly at a rate of 28%. In 2001, the average consumption inside a data centre is 1000-1600W per square metre. In 2003, the consumption is predicted to be 1600-3000W per square metre [19] (see Figure 6). This is one of the reasons for the broadening in focus of some chip-makers to include in their objectives low power consumption and not just increased computational performance [30].

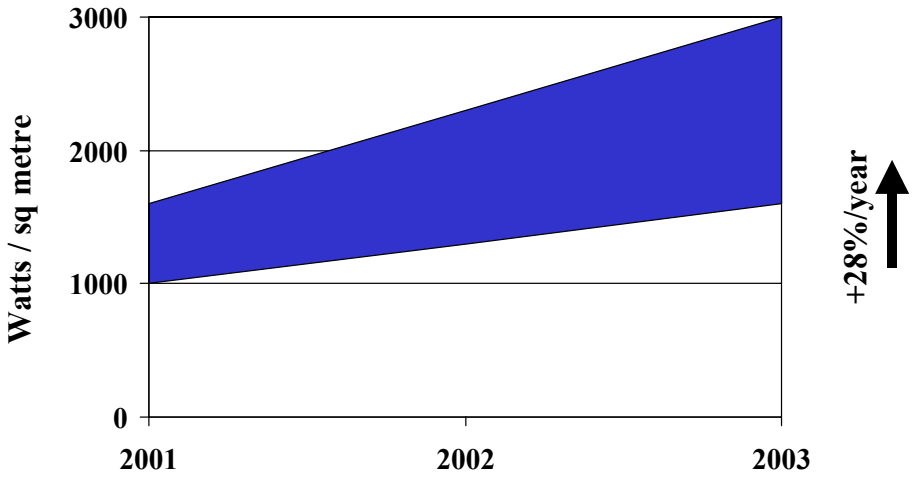

Figure 6. Electricity requirements in data centres, increase estimation from 2001 to 2003

2.3.3 Transportation is needed

The rise of business-to-consumer e-commerce benefits the traditional means of transportation.

Australia Post has been one of the companies that has benefited the most from the rise in Christmas e-shopping in Australia, as it has been the preferred method for e-shopping deliveries.

2.4 The intermediaries have not disappeared

The "irrelevance of intermediaries" has been branded as one of the big changes brought by the Internet.

However, the more nodes in an economic network the more middlemen are needed ([15], [16]).

Let's take the example of an Internet business [35] that puts in contact flower-growers all over the world with flower sellers in the USA. This business claims to allow any flower grower to sell to any florist and by-passing the intermediaries. However, the intermediary is clearly that same Internet business.

Thus, intermediaries have not disappeared; they have just changed (for a good critical review [1] or see also [23]).

2.5 The social classes are not equalised

The equal access to information and consequent equalisation of social classes is also portrayed as a characteristic of the Internet.

However, in Australia the clear difference of Internet use between city and country areas makes us believe that the Internet is just another way of identifying the current social classes [9].

Worldwide only 6% of the population has ever accessed an Internet service (for instance, e-mail or web) at least once in their life, as described by the United Nations' International Labour Organisation [32]. This means that 94% of the world population has never had direct contact with the Internet (see Figure 7). Further reading on the social impact of the Internet can be found in [31], [26] and [27].

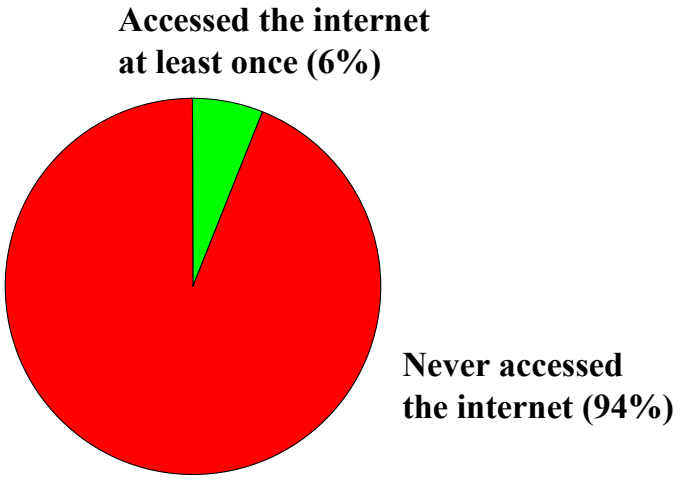

Figure 7. Percentage of world population that has used the Internet at least once

In spite of this, focussing on the business aspects and disregarding the social aspects, the Internet can be seen as a good market segmentation tool. The small proportion of the population that has access to the Internet is the population segment with higher incomes.

2.6 SMEs have not beaten the big corporation

"Company size does not matter any more" is supposedly a highlight in the Internet economy, so-called, new rules.

However, as we have seen after the e-bubble burst in April 2000 [7][18], the power of big corporations remains. Thus, instead of small companies buying big corporations, the reverse has been the norm [24]. The future of e-business is more in process automation that in client contact [24] and big corporations can benefit more from process automation as they generally have more complex processes in place.

3 Partly the Internet Revolution is already happening

3.1 The winners are the enablers

The real winners of the Internet revolution are the enablers of the Internet infrastructure (companies like Cisco, Nortel or Alcatel, for example), not the service providers (such as e-commerce companies [14]).

This fact is not new in human history. For instance, during the 19th century gold rushes, the big winners were those who sold picks and shovels, not the gold prospectors themselves (even if a very small minority of them found a big nugget, the average prospector was not a winner).

3.2 Reverse markets

Reverse markets are auctions initiated by the purchaser instead of the supplier. Optus has facilitated many of such auctions (or reverse markets) with its product NetAuction. Suppliers bid to the purchaser's request. NetAuctions normally run for 30 minutes when the invited providers log into the NetAuction system to make their bids. An example of the benefit is the cost saving of up to 33% achieved by Curtin University and BankWest when buying hotel nights [17].

One might say that the same type of reverse markets could be established via a postal and fax system used by suppliers to bid. In such case, the cost to run a reverse market would be exceptionally higher; so much so as to make it non-profitable to run. Of course, the time to run the auction would be much longer than 30 minutes.

Reverse markets are reality in the Internet business-to-business world and they will become a reality in the medium term future in the business-to-consumer space [3].

3.3 Mass personalisation

Mass personalisation (or "markets of one") can be achieved via the Internet.

Personalisation was already a feature of traditional shops where the attendant knew the customers and could recommend products as well as recall what the customer bought the last time he or she visited the shop. This is not possible, however, when the number of customers, when compared to shop assistants, explodes.

The Internet has enabled traditional personalisation to go one step further and be possible when a company has thousands or millions of customers (eg. Amazon's recommendations).

3.4 Information sharing gives power to users

The ubiquity of Internet use allows users to share information on a very large scale. Thus, information from the producer (such as feature sheets) is not needed when comparing products. Comments by other users can be more useful than the producer's information when choosing among competing products [34]. The Cluetrain Manifesto states "there is better information and support from one another than from vendors" [5].

4 The Internet is just another historical step

4.1 The Internet Revolution is similar to the Industrial Revolution

The Internet revolution has many similarities with the Industrial revolution.

It is common belief that the Internet revolution is the biggest revolution ever. However, when taken in a long-term historical context, the Internet revolution might be just another step in human evolution. This is the reason why some authors call it an evolution and not a revolution [8].

The Industrial revolution changed first business and later on consumer daily life. For example, at first, the Industrial revolution automated merely some tasks in textile production. It was much later that consumers benefited from sewing machines, washing machines and vacuum cleaners.

Nowadays, all aspects of our lives are affected by the Industrial revolution. One needs only to think about the ubiquity of car or even truck transport of goods. Both rely on the engine: a clear product of the Industrial revolution.

A good comparison between the Industrial and the Internet revolutions can be found in [1]. Some authors see the Internet as one of the enablers of a bigger revolution, which they call the "Information Society Revolution" [26][27].

4.2 Is history just a repeating loop?

4.2.1 Telegraph

Changes brought by the telegraph are very similar to changes brought by the Internet.

"Given the technological advances, newspapers must submit to their destiny and disappear." The New York Times stated this in the 18th century commenting on the big changes brought by the telegraph, yet newspapers still exist in 2001. Thus one must be sceptical when commentators write that newspapers will disappear due to the Internet.

Reading the history of the telegraph [29], one sees many similarities with the history of the Internet, such as:

- **French reluctance**. France resisted the introduction of the electric telegraph because it already had an advanced system of optical telegraphy (using flags). France was also slow in embracing the Internet because it had an advanced information system (the Minitel) which was ubiquitous in French homes.
- **Human-modem** (or human intervention in an automatic process). When the Prussian and Austrian telegraph networks were interconnected, an office was built at the borderline. There, human staff transcribed into paper the messages received from Austria, passed the

paper to their Prussian counterparts who retyped the message into the Prussian wire. The same is happening now in some of the so-called "Internet enabled companies" which receive orders via e-mail (after the customer has filled a web form) and then fax the printed e-mail into the warehouse, or key the order into some other system. Here again we have a clear case of necessary human intervention at some step of the process.

- **Success can kill**. The main advantage of the telegraph was the speed of message delivery. However, telegraph offices could become overloaded with messages and delivery became much slower than usual. Sometimes it was even faster to send the message via post than via the telegraph. Several well-publicised web site launches have been a failure due to the high number of visitors on the first day that brought the server to a stand still.
- **Last mile problem**. The last mile delivery of telegraph messages was a major difficulty for telegraph companies that led to the introduction, in some cases, of pneumatic tubes. The same can be said of Internet access, which is mainly done via infrastructure belonging to the incumbent telecom operators.
- **Profit before collapse**. There were huge profits made at the stock exchange with shares of the Transatlantic Telegraph just before it collapsed in 1854. The same can be said of Internet companies just before they collapsed during the year 2000.
- **Messages overload**. Business people complained regularly about the overload of messages that the telegraph had brought to their desks. Of course, the same applies to e-mail messages and current business people!

Other similarities between the Internet and the telegraph include return on investment problems, the regulation of codes/cyphers and the development of new ways to cheat, deceive and romance.

4.2.2 Adaptation difficulties

It is always hard to adapt to communication via a new medium.

Thus, the first TV advertisements were merely via someone reading text in front of a microphone. This is clearly just a small progression from radio advertising. It took some time until the production evolved to include moving images, yet this is the real difference between TV and radio.

Similarly, the first web presence of many companies was a mere transcription of their printed promotional material. It took some time for companies to take advantage of the interactivity offered by the World Wide Web.

4.2.3 Unavoidable tedious tasks

Machines were supposed to free the workforce from tedious and repetitive tasks. However, as Charlie Chaplin shows in his film "Modern Times" (1936), the work undertaken in a factory (with many machines) can be very tedious and repetitive.

The Internet has also brought additional tedious and repetitive tasks with, for example, increases in call-centre activity reported due to the increase in Internet usage.

5 A glimpse to the future

In a paper this brief, prediction about the future cannot be comprehensive. Thus, this section provides a few points on the future of the Internet and its impact in our lives. Other views and perspectives on the future can be found elsewhere (for instance [2], [11], [31], [25] and [36]).

5.1 Peer-to-peer networks change the rules

Peer-to-peer (P2P) networks allow peers to build a system of transactions or interaction that does not rely on a central server or service. The most common examples are of software or file sharing such as Napster or Gnutella.

One example of an enabler at the network level is Cybiko [33] (other examples in [10]). A Cybiko unit is a transmitter-receiver that sends, receives and relays messages or packets. The Cybiko units have a range of 50-200 metres. When a unit receives a message or packet that is not addressed to it, the message or packet is just relayed. Thus the units themselves form the network (see Figure 8).

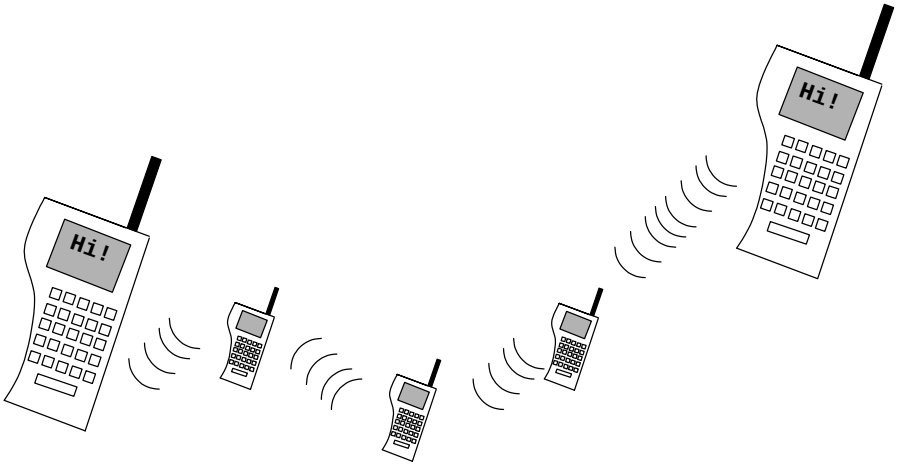

Figure 8. Example of peer-to-peer transmission by Cybiko units building a network

The more users, the more bandwidth is available (see Figure 9). This turns upside-down the rule, in traditional networks, that a given bandwidth is shared by the users. Just imagine the power of such networks, if Cybiko type units were pre-installed in every car!

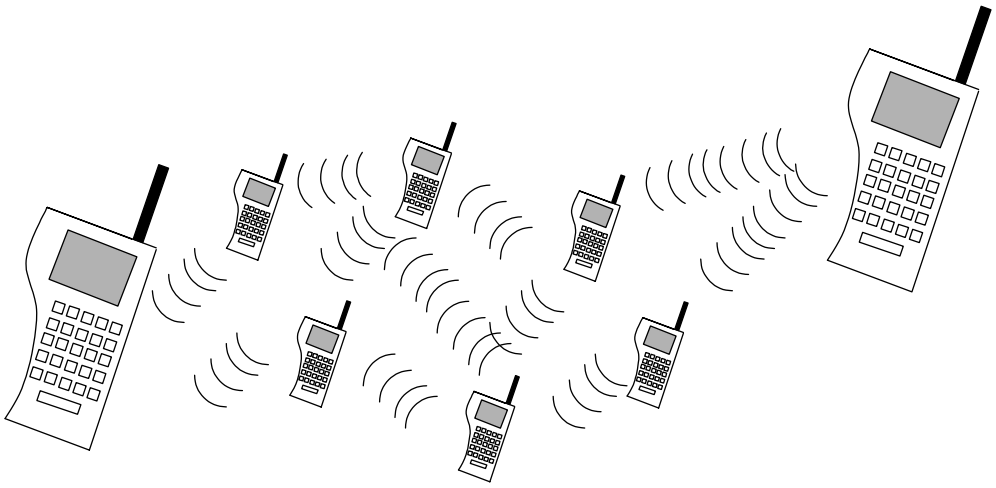

Figure 9. The more users, the more bandwidth in peer-to-peer networks

Cybiko is just an example. Other examples show how P2P networks can be used for cheap telephone communication [4]. P2P standards are being developed ([22], [37], [38]) and will shape the networking future. Chip manufacturers are involved in P2P standards [12] as they believe it is essential in future network protocols.

5.2 Personal document repository

Any user will be able to have a personal document repository residing somewhere in the net with characteristics such as:

- Format independence. The documents will be viewable without the software used to create them (eg. MS Word). Standards such as XML might be used for this purpose.
- Notes and marks. The user will be able to annotate and mark documents for further use.
- Accessible from anywhere.

It is possible today to have a document repository with the first two characteristics: a traditional drawer with annotated paper version of documents!

5.3 Ubiquity better than bandwidth

Ubiquity will be more important than bandwidth.

Nowadays, high-bandwidth access and ubiquity are often offered jointly (eg. cable modem and ADSL access).

However, users of such systems normally give more importance to the "always-on" feature than the higher bandwidth.

5.4 Content-based networking will be the norm

When content-based networking is used, the content of IP packets is used to route the packets, instead of only using the IP headers (as shown in section 1).

For instance, a router may divert packets related to a purchase order of high value items towards a premium server, while other packets are sent to the standard server.

5.5 Open Systems Interconnection (OSI) compression

The OSI 7 layers are being compressed into 3 layers.

The Open Systems Interconnection (OSI) model, which was developed in the 1970s, proposed seven layers in any communication system. Thanks to recent advances (such as MPLS or Multi-Protocol Label Switching, lambda switching and IP over fibre, etc) the lower three layers might be seen as a single layer (let's call it NDP for Network-Data-Physical). The upper three layers can also be seen as a single layer (APS for Application-Presentation-Session) due to the software engineering advances (see Figure 10).

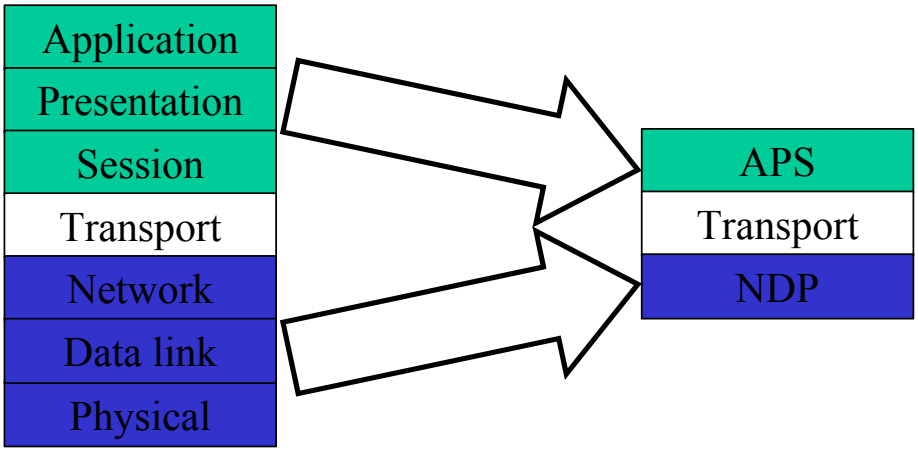

Figure 10. Only 3 layers are needed in the OSI Model

5.6 Quantum Internet

Quantum computers do not rely on electronics but on quantum physics. Research is still ongoing in this area [28]. If a quantum computer is built, it will be able to perform computation at a complexity not possible with current computers (even super-computers).

For quantum computers to be useful they will require connections between them. To be able to make quantum connections, quantum teleportation is needed[4]. Research is active in this area and quantum teleportation has been achieved over a few metres ([25], [20]).

The Quantum Internet will be made of computers connected via quantum connections. This provides for huge calculation power units connected at arguably infinite speed since quantum connections are distance independent and thus are not impacted by the speed of light!

6 Let's make the Internet happen!

The Internet has to date delivered in many areas. However, some of the earlier expectations have not been realised. It might be argued that the expectations were set at a too high a level by the media hype around the Internet.

[4] Quantum teleportation involves the entanglement of photons over optical fiber and other complex processes (see [28]).

In any case, it is our role as technologists to enable the Internet to be more "happening" and less "hype".

We should:

- regularly perform reality checks on the business and media hype.
- help business deliver on the Internet areas it can deliver on.
- pro-actively innovate in the interaction between technologies as to make the whole more valuable than the sum of the parts.

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