

# ***Societal Impacts of Electronic Communication Networks***

---

## ***What's the future of the internet?***

Dr Boris Grémont

School of Engineering

Faculty Technology Outreach Conference

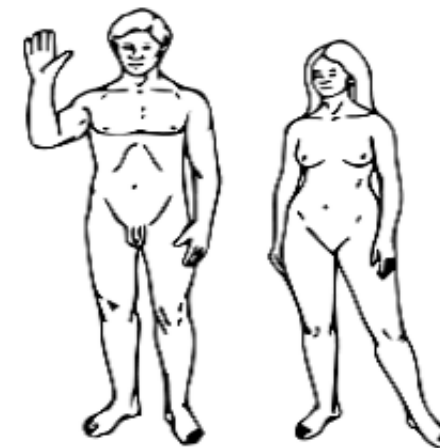
27<sup>th</sup> January 2012

## Why do we need to communicate?

- **Wikipedia “Human”:** *Homo sapiens* (Latin: "wise man" or "knowing man") in the family Hominidae (the great apes). Humans have a highly developed brain capable of abstract **reasoning, language, and introspection**. This mental capability, combined with an erect body carriage that frees their upper limbs for manipulating objects, has allowed humans to make far greater use of **tools** than any other species.

The capacity humans have to transfer concepts, ideas and notions through speech and writing is unrivaled in known species. The faculty of **communicating is a defining feature of humanity**. Language is central to the communication between humans, as well as being central to the sense of identity that unites nations, cultures and ethnic groups. The invention of writing systems around 5000 years ago allowed the preservation of language on material objects, and was a major step in cultural evolution.

**The sharing/passing of information is central to the success of homo sapiens.**



Source: <http://en.wikipedia.org/wiki/Human>

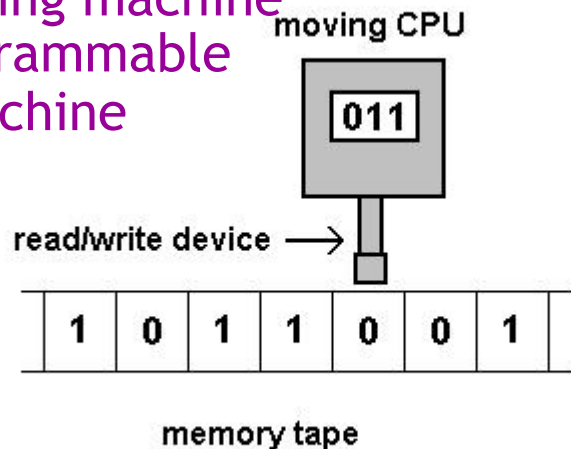
## The Turing Machine (1936)

- a "tape", a ribbon of paper of indefinite length.
- a "head" that can read the symbol, chose to write a new symbol in place, and then move left or right.
- The program or instructions are on the tape



**Alan Turing**, Born 23 June 1912 London, Died 7 June 1954 (aged 41)

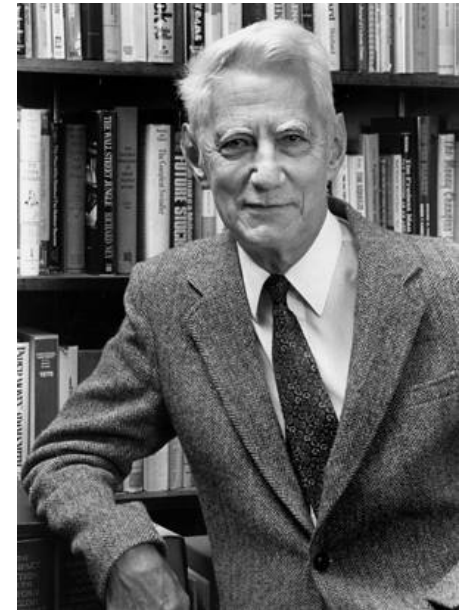
•The Turing machine is a programmable state machine



•The tape is used to store data. In addition, it can also store a series of transitions (a small programs) and thus, the head can run "sub-programs". We then say a Turing machine is emulating another one (the one on the tape).

## What is Information?

- **Information** is a term with many meanings depending on context
- Common sense day to day definitions
  - **Knowledge communicated or received concerning a particular fact or circumstance**
  - **Knowledge gained through study, communication, research, instruction**
  - **The act or fact of informing**
- In Engineering or Science, we use a different definition (Mathematical field called information theory, 1948):
  - **Entropy= A measure linked to the number of possible choices or messages and the surprise associated with the possible messages (information theory)**
  - **the result of processing, manipulating and organizing data in a way that adds to the knowledge of the person receiving it.**
  - Applications of fundamental topics of information theory include **lossless data compression** (e.g. ZIP files), **lossy data compression** (e.g. MP3s), and **channel coding** (e.g. for DSL lines).



Claude Elwood Shannon  
(April 30, 1916 – February 24, 2001)

## *The meme concept: cultural information*

- A **meme** is a unit of **cultural information** that propagates **from one mind to another** as a theoretical unit of cultural evolution and diffusion, analogous to the way a gene propagates from one organism to another as a unit of genetic information and evolution.
- **A bit like a virus**
  - Good Jokes
  - Technology (e..g fire, the wheel, the printing press etc ...)
  - Ideas
  - Fashions
  - Education
  - Religions
  - Etc...

facebook



**Richard Dawkins**,  
*The Selfish Gene*,  
*Memes: the new replicators*, Oxford University, 1976.

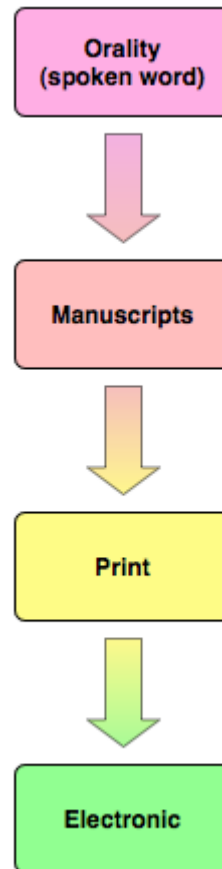
### Relates somehow to the concept of “Data”

- “A representation of facts, concepts, or instructions in a formalized manner **suitable for** communication, interpretation, or processing by humans or by automated means.”
- Information, knowledge, and conceptions, related to data, people, or things, obtained by observation, investigation, interpretation, visualization, and mental creation. **Data are intangible** and include numbers, words, symbols, ideas, concepts, and oral verbalization.

Source: <http://en.wikipedia.org/wiki/Meme>

## *Some Key Elements of a Data Communication System*

- Transformation of human knowledge/information into a format suitable for processing through systems
- Storage of information
- Reliable & Efficient Transmission/Reception of information to single/multiple destinations



- Communication through time = Storage systems
- Communication through space
  - **Point-to-point** (telephone)
  - **Networks** (telegraph, internet...)
  - **Broadcasting** (TV)
  - **Multicasting** (Pay TV)
  - Unicasting

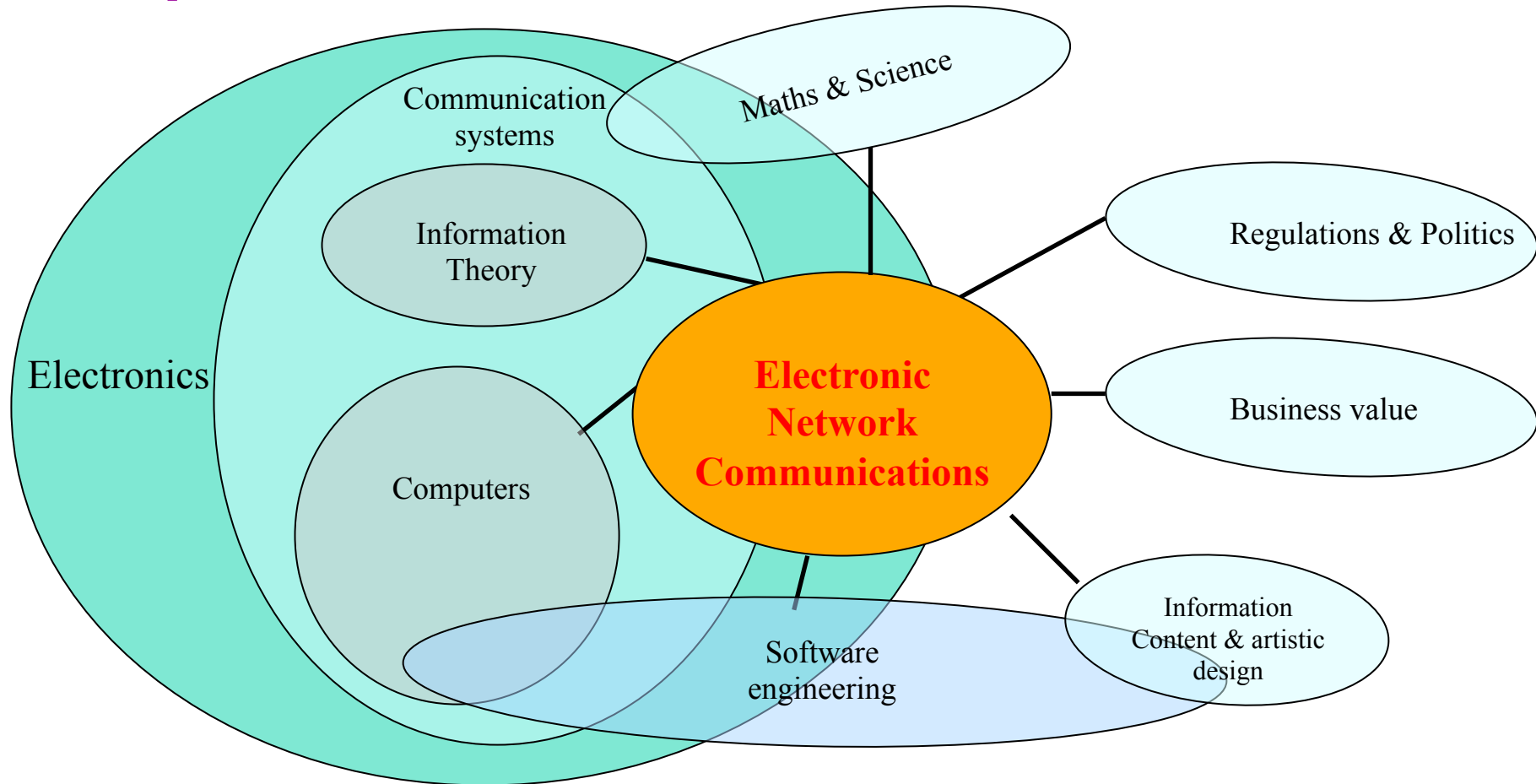
## *The Global Village*

- **Global Village** was a term probably first coined by Marshall McLuhan and Quentin Fiore in the 1967 book *The Medium is the Message* (p. 63, 1967 edition). **The term means that due to the speed of electric communication all the human society started to implode, and we have gone back to the village way of life.** We all start to know each other and communicate in an instantaneous way.
- Note McLuhan's characteristic stress on the importance of awareness of a medium's cognitive effects: If we are not conscious of how technology impacts cognition and society, the global village has the *potential* to become a place where totalitarianism and terror rule. On the other hand, it *could* create a problem-solving world-wide forum, enabling a new sense of world community.
- It is likely that the global village will be both good and bad at the same time reflecting the full expectable range of human experiences



[http://en.wikipedia.org/wiki/Global\\_village\\_%28Internet%29](http://en.wikipedia.org/wiki/Global_village_%28Internet%29)

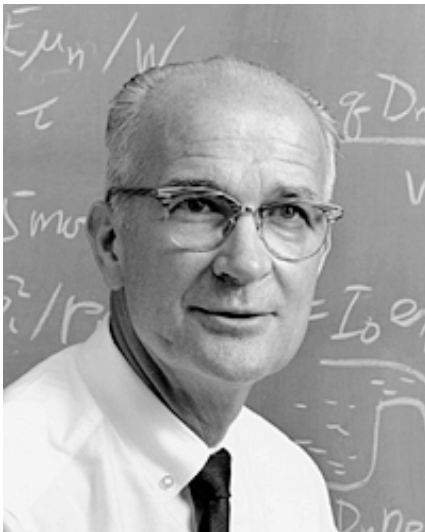
## *A possible view of Electronic Networks*



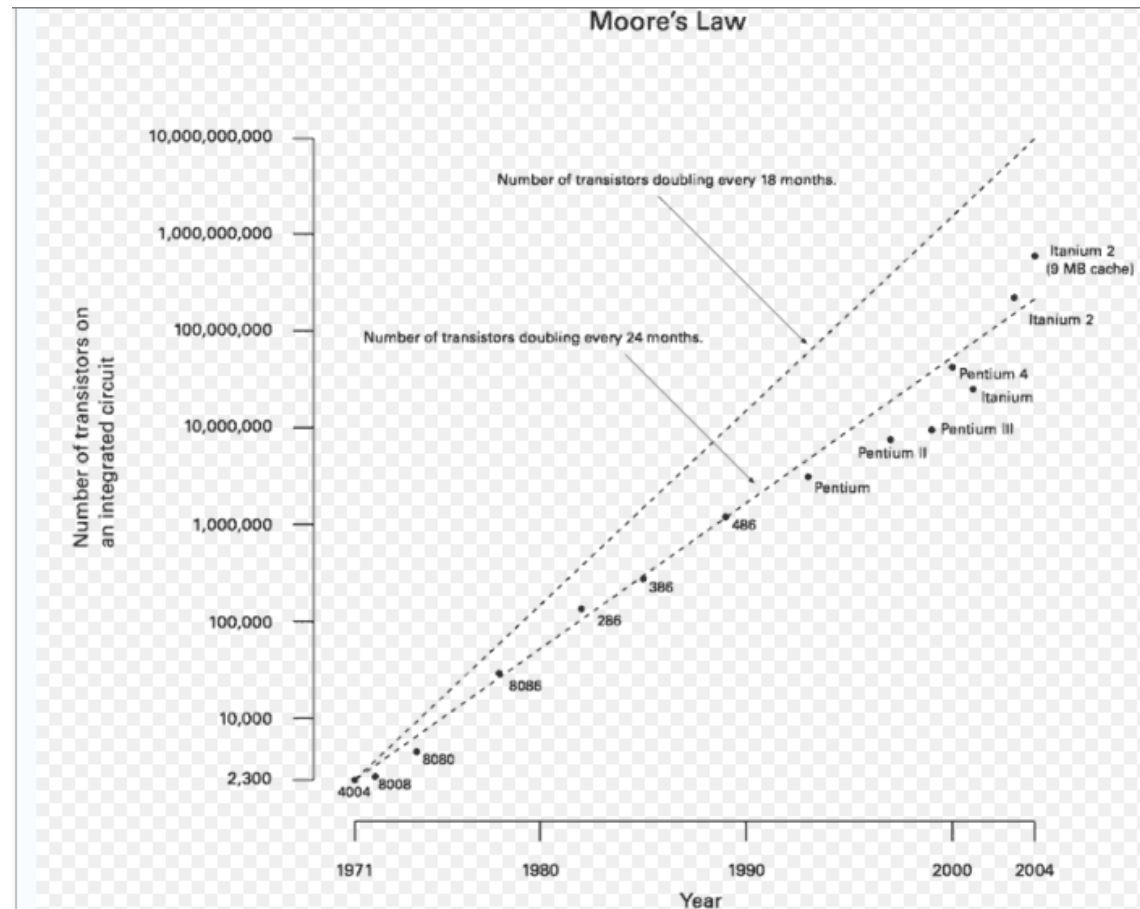


# Moore's Law

- **1947 William Shockley: First ever transistor**
- **The most popular formulation is of the doubling of the number of transistors on integrated circuits every 18 months.**



"Cramming more components onto integrated circuits",  
*Electronics Magazine* 19 April 1965



## Kryder's law

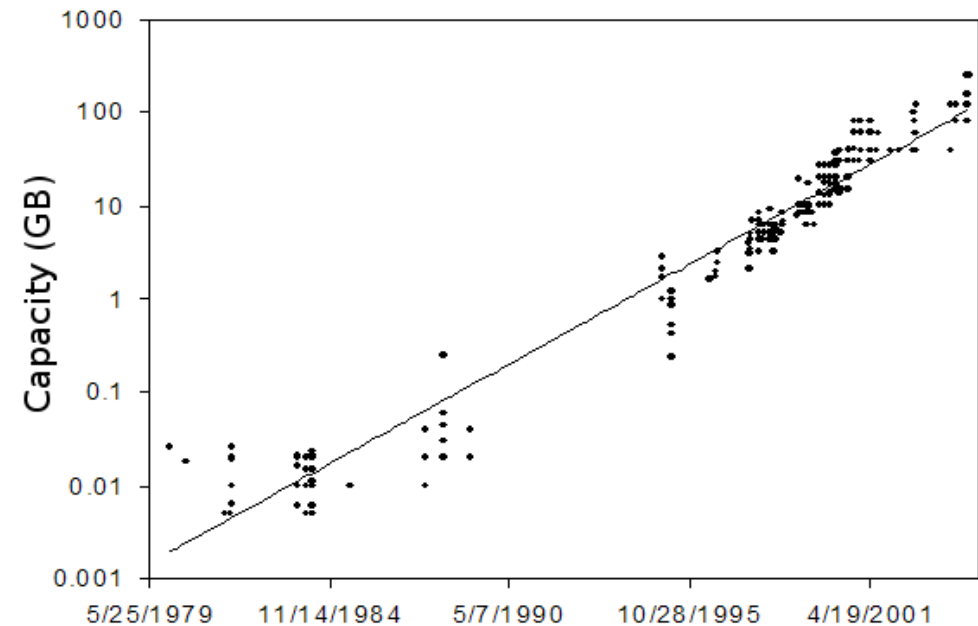


- for hard disk storage cost per unit of information.
- **magnetic disk areal storage density doubles annually**



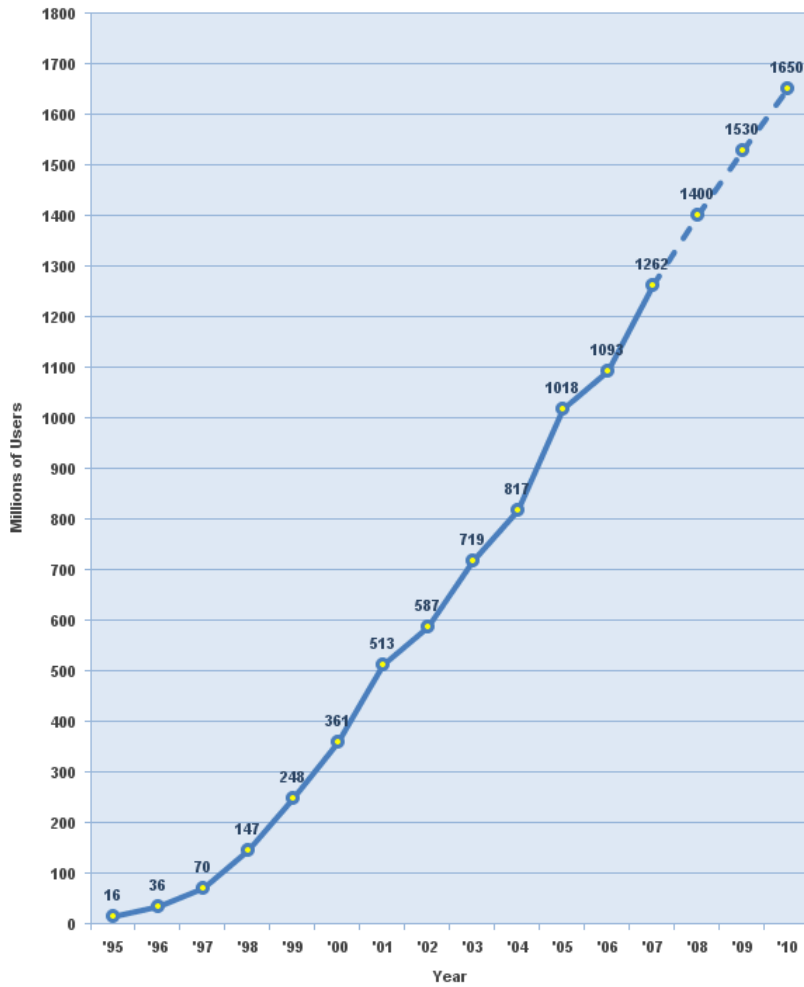
The on-going rise of data centres  
and cloud computing

Hard drive capacity



[http://en.wikipedia.org/wiki/Moore's\\_law](http://en.wikipedia.org/wiki/Moore's_law)  
[http://en.wikipedia.org/wiki/Mark\\_Kryder](http://en.wikipedia.org/wiki/Mark_Kryder)

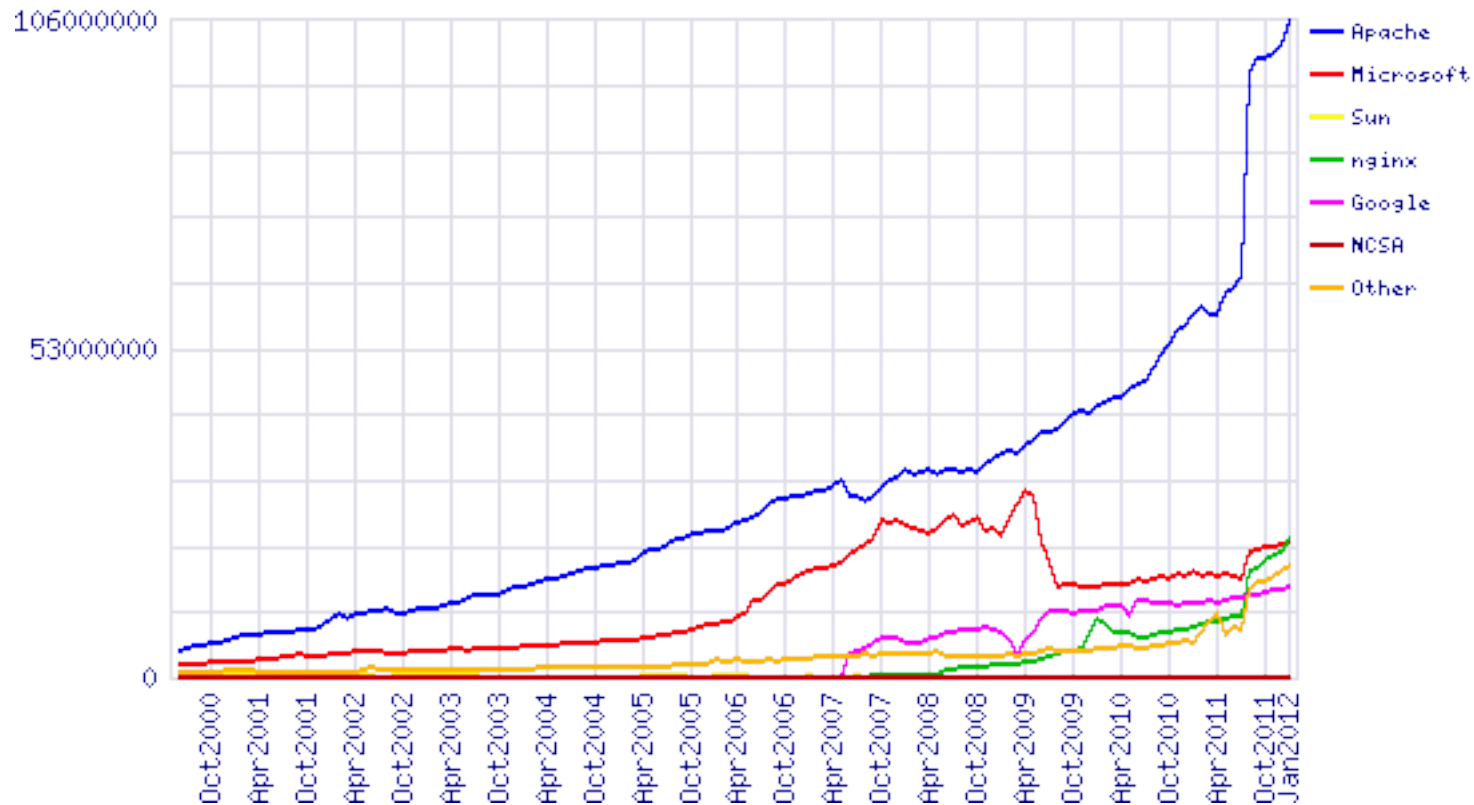
### Internet Users in the World Growth 1995 - 2010



Source: [www.internetworldstats.com](http://www.internetworldstats.com) - January, 2008  
Copyright © 2008, Miniwatts Marketing Group

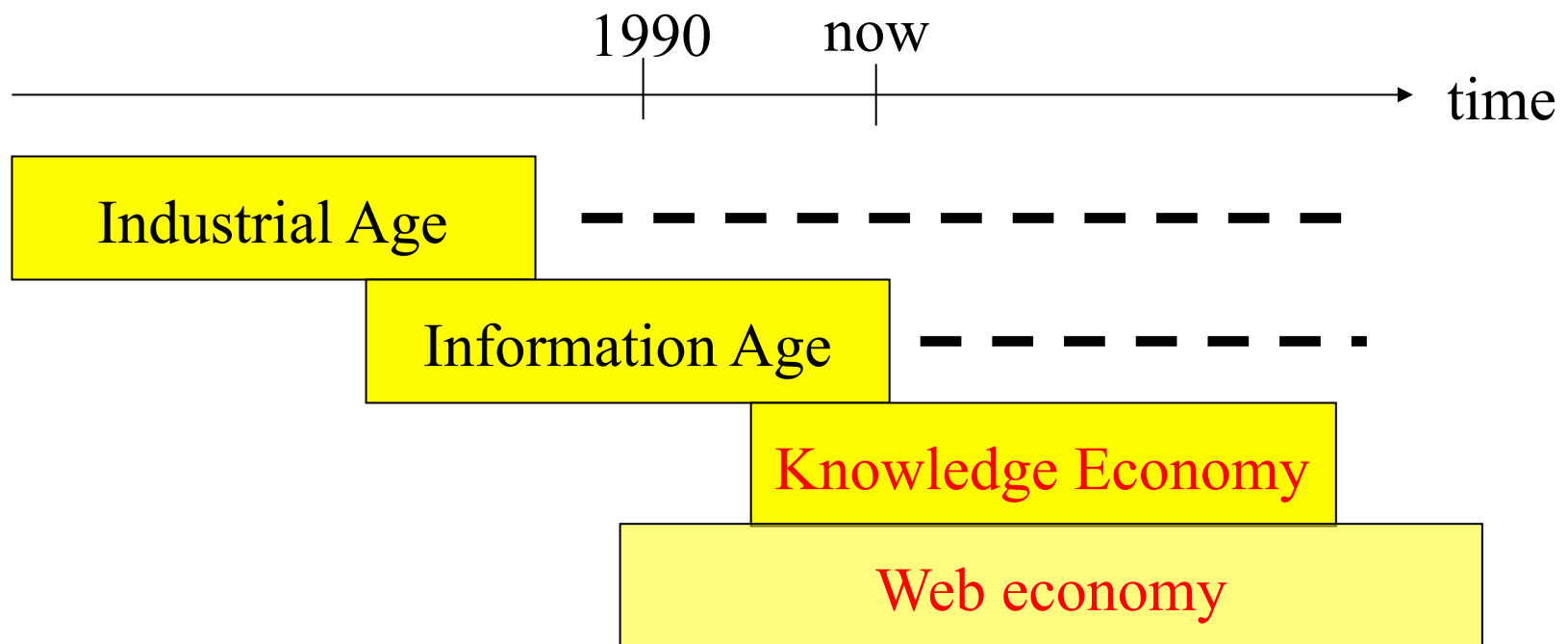


## No of web servers



<http://www.pamil-visions.net/nginx-web-server/232144/>

## Main “Ages” in Recent Human History



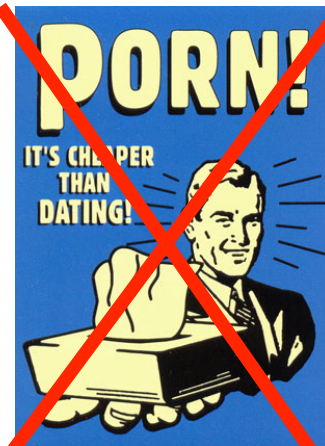
## *E-commerce (aka the Web economy)*

- **Electronic Commerce** is exactly analogous to a marketplace on the Internet. **Electronic Commerce** (also referred to as **EC**, **e-commerce** **eCommerce** or **ecommerce**) consists primarily of the distributing, buying, selling, marketing and servicing of products or services over electronic systems such as the Internet and other computer networks.

- The information technology industry might see it as an electronic business application aimed at commercial transactions; in this context, it can involve electronic funds transfer, supply chain management, e-marketing, online marketing, online transaction processing, electronic data interchange (EDI), automated inventory management systems, and automated data collection systems.

- **Electronic commerce typically uses electronic communications technology of the World Wide Web, at some point in the transaction's lifecycle, although of course electronic commerce frequently depends on computer technologies other than the World Wide Web, such as databases, and e-mail, and on other non-computer technologies, such as transportation for physical goods sold via e-commerce.**

- According to the October 2006 Forrester Research report entitled, "US eCommerce: Five-Year Forecast And Data Overview, "Nontravel online retail revenues will top the **quarter-trillion-dollar mark by 2011**



Over a tenth of all websites are pornographic, a quarter of search engine requests are for porn  
**UK GDP approx \$2 trillion (2006 est.)**

## *Information Age*

- **Information Age** is a name given to a period after the industrial age and before the Knowledge Economy. **Information Age is a term applied to the period where information rapidly propagated, more narrowly applying to the 1980s onward.** Under conventional economic theory, the Information Age also heralded the **era where information was a scarce resource and its capture and distribution generated competitive advantage**
- It is often used in conjunction with the term post-industrial society. When information ceased being scarce, the Knowledge Economy commenced.
- An **information society** is a society in which the creation, distribution, diffusion, use, and manipulation of information is a significant economic, political, and cultural activity. The knowledge economy is its economic counterpart whereby wealth is created through the economic exploitation of understanding.



[http://en.wikipedia.org/wiki/Information\\_Age](http://en.wikipedia.org/wiki/Information_Age)

[http://en.wikipedia.org/wiki/Information\\_society](http://en.wikipedia.org/wiki/Information_society)

# Knowledge Economy

started around 1997

- A **knowledge-based economy**= the **use of knowledge to produce economic benefits**.
- The phrase was popularised if not invented by **Peter Drucker** as the heading to chapter 12 in his book "The Age of Discontinuity"
- A key concept of this sector of economic activity is that knowledge and education can be treated as:
  - A business product, as educational and innovative intellectual products and services can be exported for a high value return.
  - A productive asset

**"If a country hasn't got oil, it must have ideas instead."**



They want to hire the use of your brain

The creation and exploitation of "intangibles" such as computer software and intellectual property are at the heart of the knowledge economy. They are a required complement to energy sources and raw materials.







## *Your role in all this?*

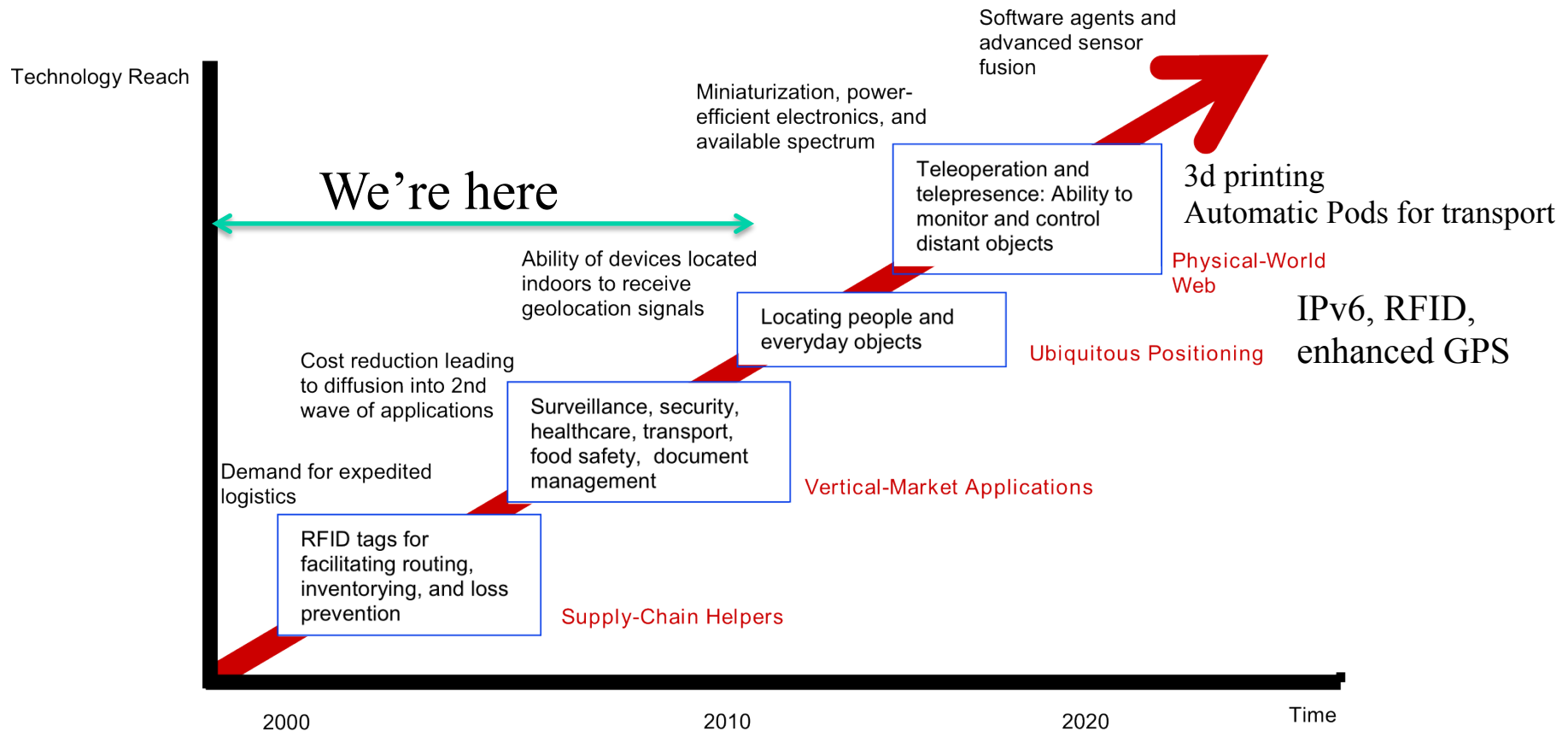
- **What is Engineering?**
- "Engineering" = "**ingenuity**" from latin.
- An engineer is by definition a **technical creator** who **improves products or solutions** by solving sometimes complex technological problems **in order to facilitate further the life of people.**
- Engineering is the profession of or work performed by an engineer. Engineering involves the knowledge of mathematical and natural sciences (biological and physical) gained by study, experience, and practice. This **knowledge is then applied with judgement, rigour and creativity to develop new or develop better ways to utilize the materials, technologies and the forces of nature for the benefit of society.**

## ***The Significance of Your Studies @ uni?***

- To be able to contribute to the knowledge economy you must imperatively **acquire knowledge** and **know-how** in your chosen area of specialism
- **Electronic network communications have a bright future.**
- Over the whole of history, your career prospects have never been so-much dependent on how and what you will achieve in your studies.

# Internet of things and beyond

TECHNOLOGY ROADMAP: THE INTERNET OF THINGS



Source: SRI Consulting Business Intelligence

## *Conclusions*

- General Introduction
- Tried to provide an historical background
  - Transistor
  - Turing Machine => computer
  - Shannon's information theory
  - Moore's and Kryder's law
- Introduced important concepts of
  - Information age
  - Knowledge economy
  - Intangible & Web economy
  - Internet of things



Thank You!