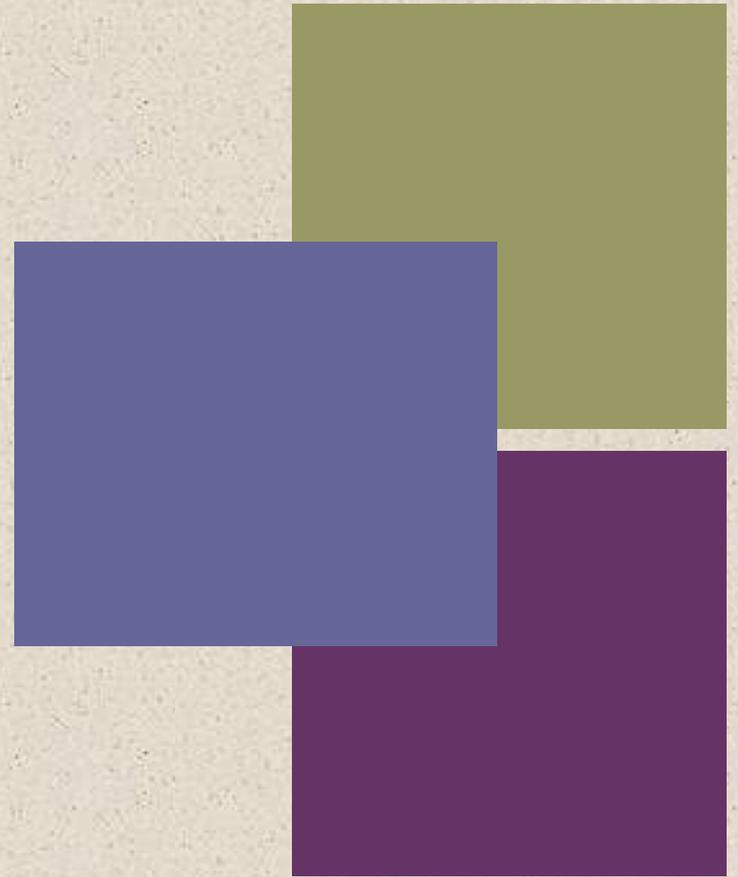


Emerging Technology & Computer Science

Emerging Technologies

**Can You See Them
Coming?**

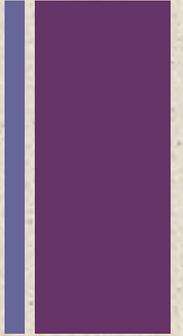
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Emerging Technology

新兴技术



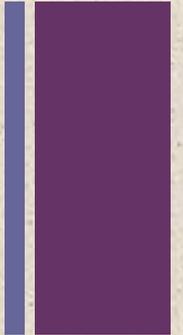
Technology is changing every day. Many truly cutting-edge technologies are quickly emerging that will dramatically change how you interact with your computer and forever change how you live your life.

Definition of ET:

- Technology based on new ideas that are in development and testing
- Testing is used to determine if products give the intended results.
- If so, products can be mass-produced.



Emerging Technologies



- EMR health
- Autonomous cars
- Biocomputing
- 3D displays
- Agricultural robot
- Computer-generated holography
- Ambient intelligence
- Telemedicine
- Artificial brain
- Semantic web
- Cybernetics
- Radio-frequency identification (RFID)
- 3D printing
- Biometrics

Virtual Reality

Definition:

- Technology that allows the user to interact with an environment that exists only on a computer
- A three-dimensional computer simulation in which you actively participate
- Special input and output devices needed
- Glove, headset, Walker



VR

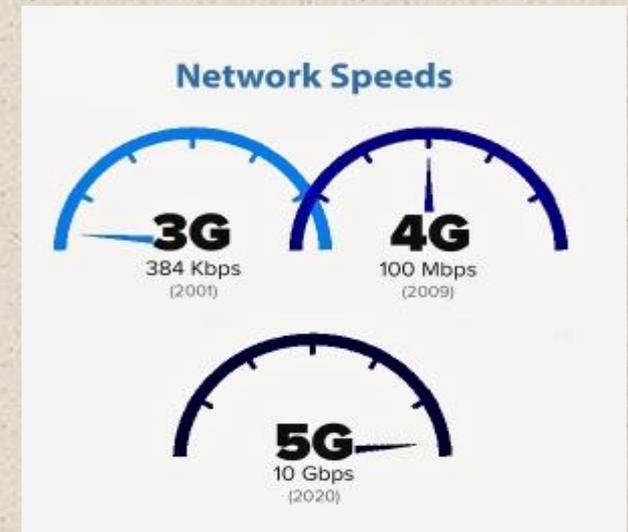


Fourth Generation Cellular Communication

4G

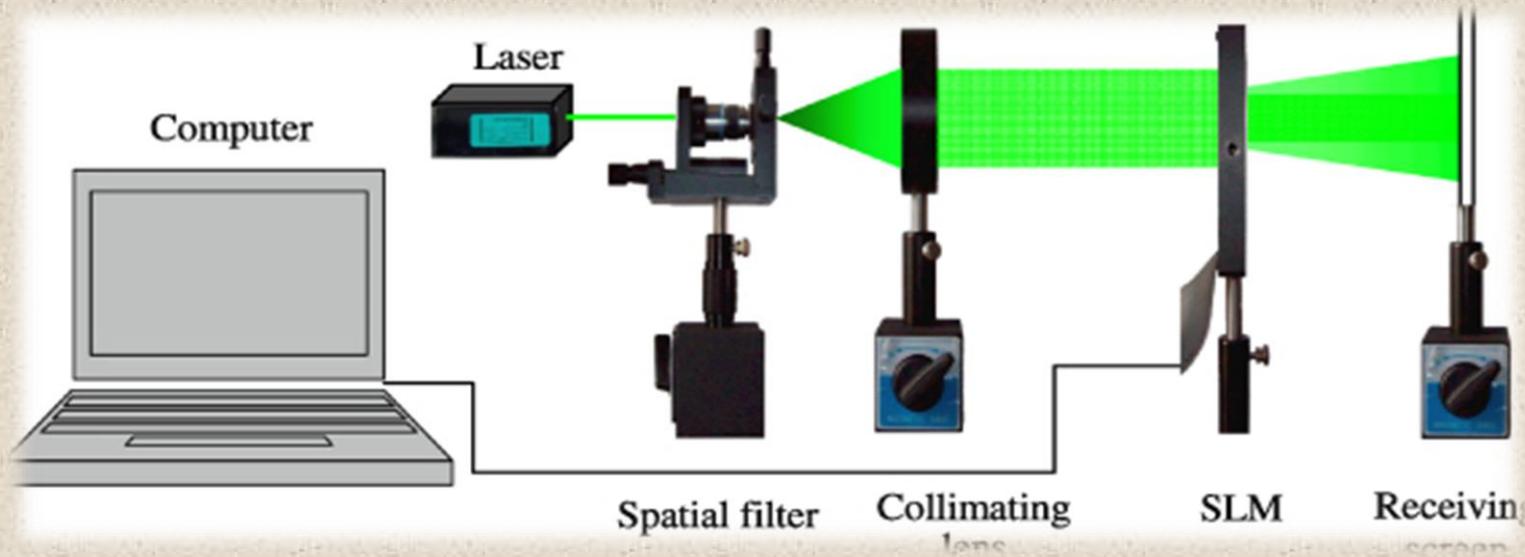
Definition:

- A type of technology commonly used in mobile devices
- Compared to 3G:
 - Accesses the Internet faster
 - Offers high-definition video and high-quality voice
 - Offers improved data rates on wireless channels

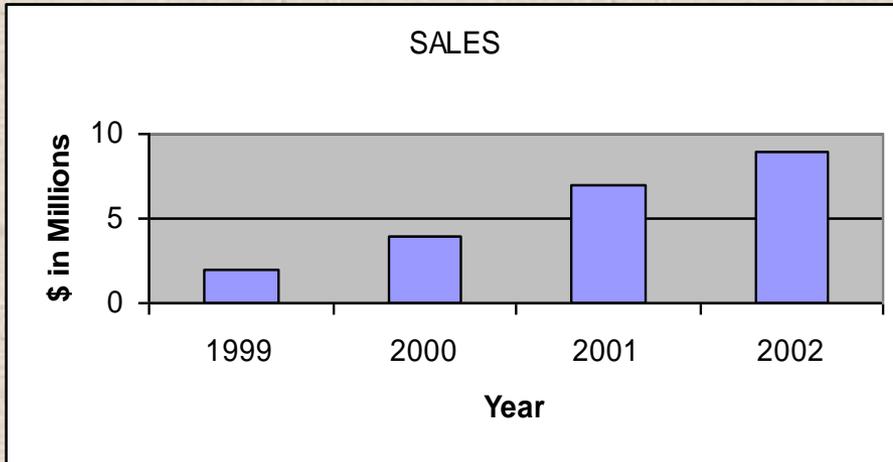


Computer-generated holography

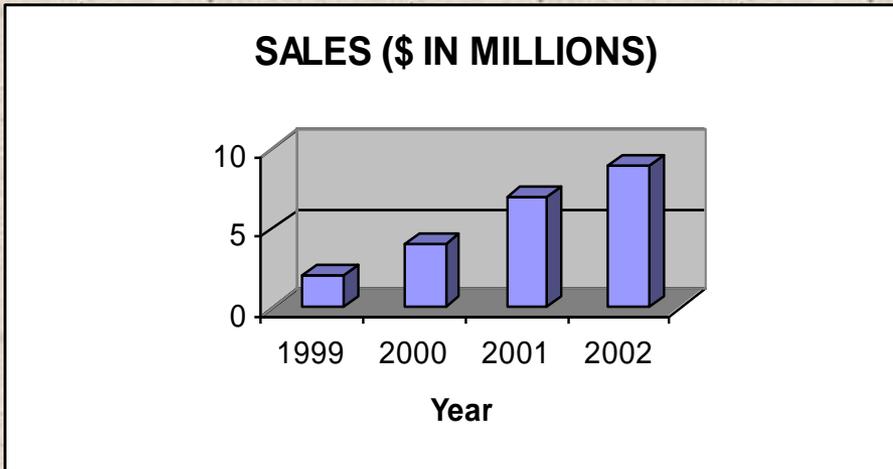
A holographic image can be generated e.g. by digitally computing a holographic interference pattern and printing it onto a mask or film for subsequent illumination by suitable coherent light source.



Real 3-D



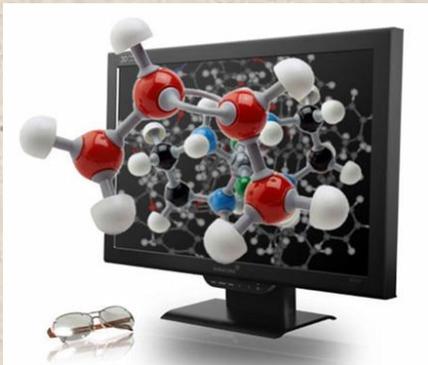
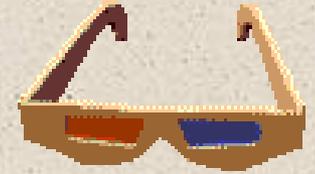
Two-dimensional presentations of information show only length and width.



Pseudo three-dimensional presentations of information incorporate shadowing to show depth.

+ 3D Displays

- 3D displays create the illusion of depth by presenting a different image to each eye
- Can turn image to reflect different angles & perspectives
- Already available on some Web sites
- Real 3-D is becoming more popular
 - Limited by computer speed and capacity
 - Newer and cheaper computers will make real 3-D more available



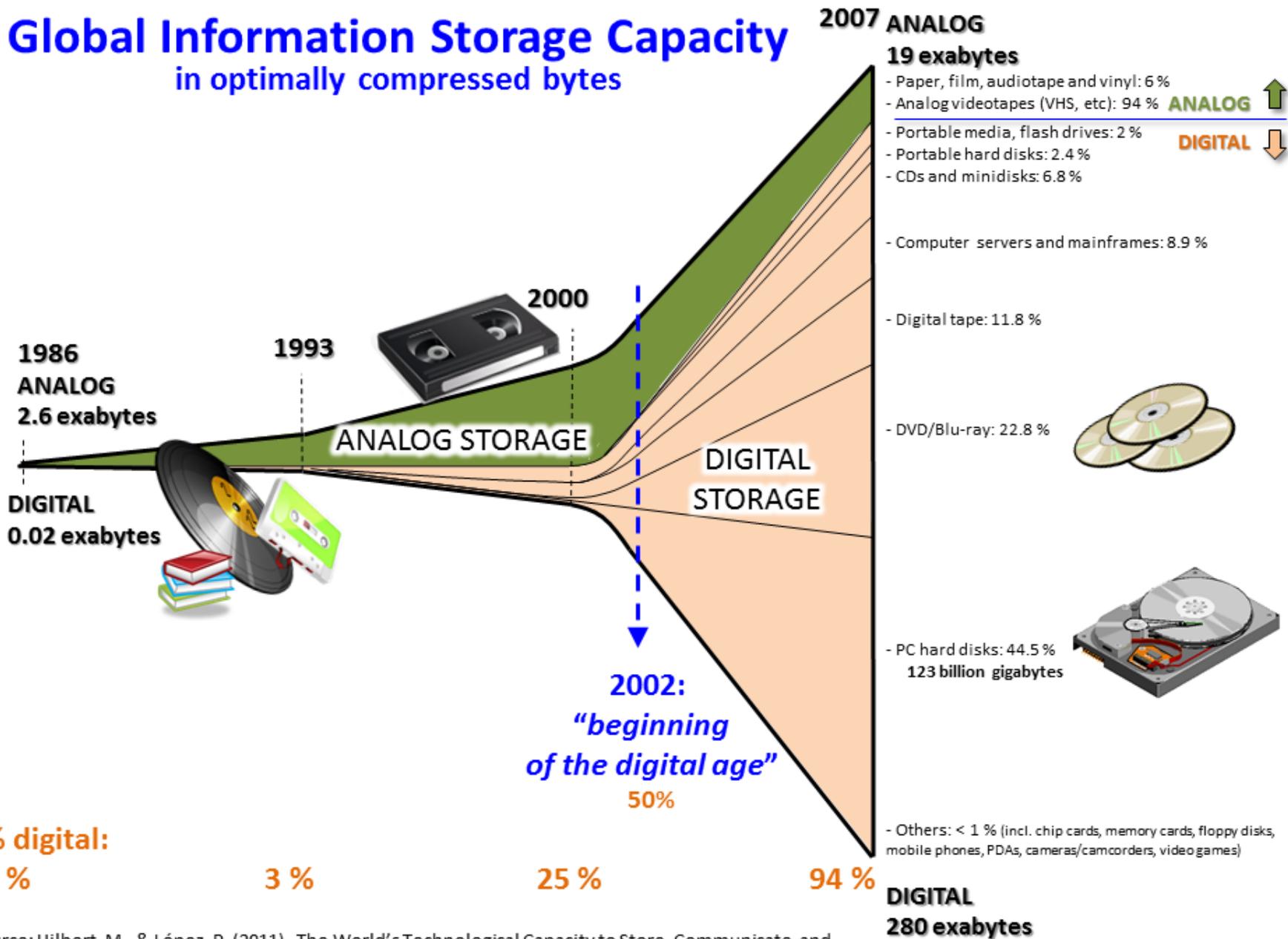
+ Big Data

■ Definition:

- The collection of large amounts of data.
- An enormous collection of information to further knowledge or create knowledge.
 - Scientists using computer skills to evaluate large amounts of data without using traditional methods.
 - The responsibility of a scientist to work with computer intelligence to assist in the study of the data collected.



Global Information Storage Capacity in optimally compressed bytes



Source: Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, 332(6025), 60 –65. <http://www.martinhilbert.net/WorldInfoCapacity.html>

+ Touch Screen Computing & Wearable Computers

- Touch screen:
 - A type of display screen that has a touch sensitive panel covering the screen
 - The user points at objects on the screen and activates them with his/her finger.
- Wearable computers : Technology so small and so portable that you'll be wearing it



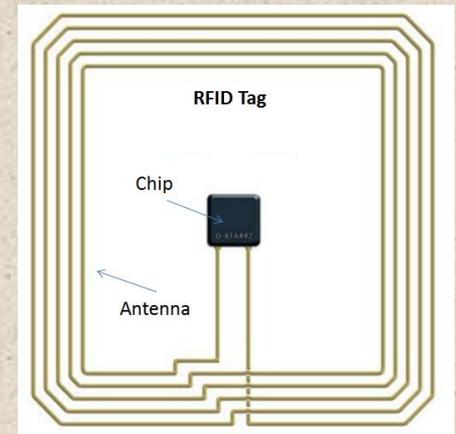
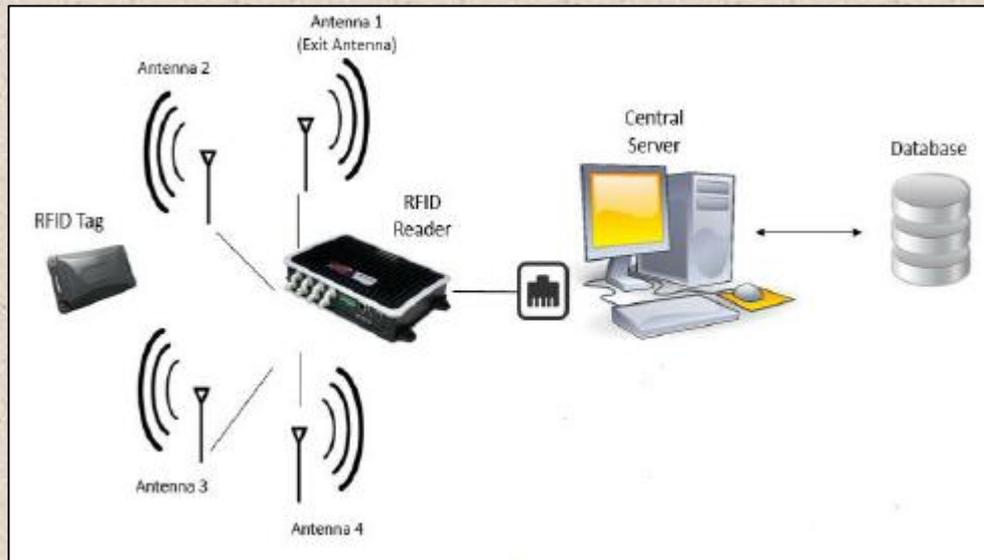
+ Ambient Intelligence

- Electronic environments that are sensitive and responsive to the presence of people
- Any immersive, personalized, context-aware and anticipatory characteristics brings up societal, political and cultural concerns about the loss of privacy, as soon as any third party gets control over the respective information and status data.



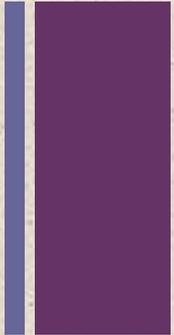
+ Radio Frequency Identification(RFID)

- use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking
- <https://www.youtube.com/watch?v=yNPDgudPmXE>

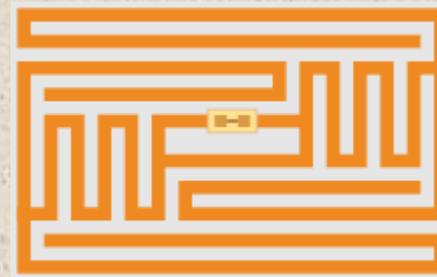




- RFID can be used in a variety of applications, such as:
 - Access management
 - Tracking of goods
 - Tracking of persons and animals
 - Toll collection and contactless payment
 - Machine readable travel documents
 - Smart dust (for massively distributed sensor networks)
 - Airport baggage tracking logistics
 - Timing sporting events
 - Tracking and billing processes



RFID E-ZPass reader attached to the pole and mast arm (right) used in traffic monitoring in New York City

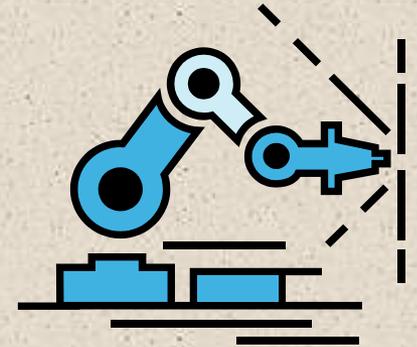


An EPC RFID tag used by Wal-Mart.

Robotics

■ Definition:

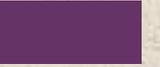
- Branch of technology that deals with the manufacture and application of robots and the computer systems that control them
- Used to perform tasks that are dangerous to people or are boring or repetitive.



Agricultural Robots

- A robot deployed for agricultural purposes
- **Harvest Automation, Inc.** is a robotics startup founded by several former iRobot employees. Their first robot is targeted at the floriculture industry and is designed to move potted plants on nursery container farms, an application currently done by hand.





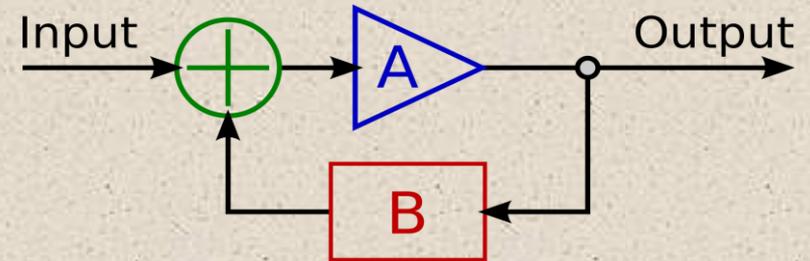
Developing Technologies



Artificial Intelligence

■ Definition:

- The science and engineering of intelligent machines that can be used to solve problems
- It extends beyond the limitation of human thinking to solve problems that humans cannot.



Cybernetics

- The word cybernetics comes from Greek κυβερνητική (kybernētiké), meaning "governance"
- After some uneasy coexistence, AI gained funding and prominence. Consequently, cybernetic sciences such as the study of neural networks were downplayed; the discipline shifted into the world of social sciences and therapy.
- It's a system being analyzed is involved in a closed signaling loop; that is, where action by the system generates some change in its environment and that change is reflected in that system in some manner (feedback) that triggers a system change, originally referred to as a "circular causal" relationship

Biometric Authentication

- The use of physical characteristics to provide identification

- Fingerprints
- Blood vessels in the retina of your eye
- Sound of your voice



- Already used in high-security environments such as military installations

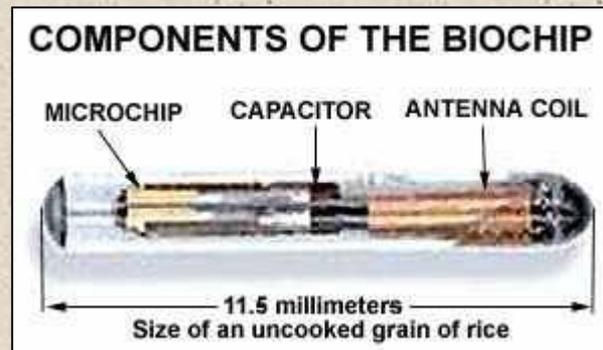
- Behavioral Biometrics:

- Identification of a person using physical traits
- Identification of a person's behavioral traits



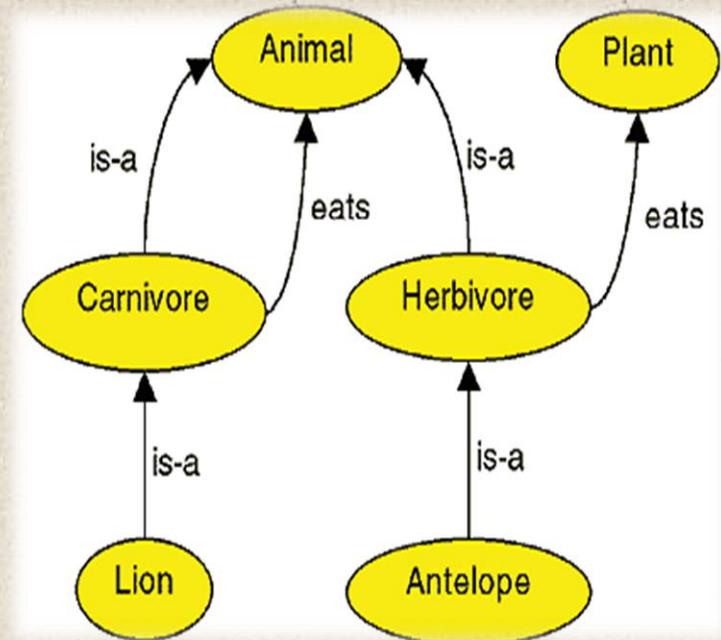
Biochips and Implant Chips

- **Biochip** is a technology chip that can perform a variety of physiological functions when inserted into the human body
- **Implant chip** is a technology-based microchip implanted into the human body
- Types of biochip:
 - DNA chip
 - Protein chip
 - Enzyme chip
 - Lab-on-a-chip
 - Bio computer



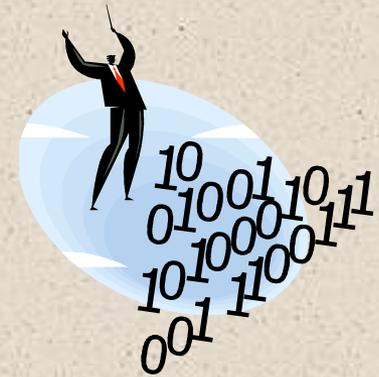
+ Semantic Web

- Semantic Web aims at converting the current web dominated by unstructured and semi-structured documents into a "web of data".
- The original 2001 *Scientific American* article by Berners-Lee described an expected evolution of the existing Web to a Semantic Web, but this has yet to happen. In 2006, Berners-Lee and colleagues stated that: "This simple idea ... remains largely unrealized."
- 'I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers.
- A "Semantic Web", which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The "intelligent agents" people have touted for ages will finally materialize.'



HTML Version 5

- The latest version of the code used to develop web pages
- Predicted Advantages
 - Streamlining webpage elements
 - Embedding graphics and multimedia
 - Faster, more efficient environment



Nanotechnology

- A multidisciplinary science that explores how matter can be manipulated at the molecular and atomic level (Nanotechnology is the study of controlling individual atoms and molecules)
- Involves the building of tiny machines that might be used to create tiny robots that can perform tasks humans cannot



Web 3.0

- An Internet browser that will make it possible for a user to find multiple results from one search
- The browser interprets complex search statements, searches all possible results, and organizes the results.



3D Printing

- process of making a three-dimensional solid object of virtually any shape from a digital model

<https://www.youtube.com/watch?v=S-E6vRfnijw>



The Changing Internet

**Internet-based trends
and
Internet-enabled technologies**

```
graph LR; A[Internet-based trends and Internet-enabled technologies] --> B[E-cash]; A --> C[Renting software from ASPs]; A --> D[True personalization]; A --> E[Internet-enabled home];
```

E-cash

**Renting software
from ASPs**

True personalization

Internet-enabled home

E-Cash

- Electronic representation of cash
- Can buy products on the Web by sending the e-cash file to a merchant
- Far beyond digital money & wallets

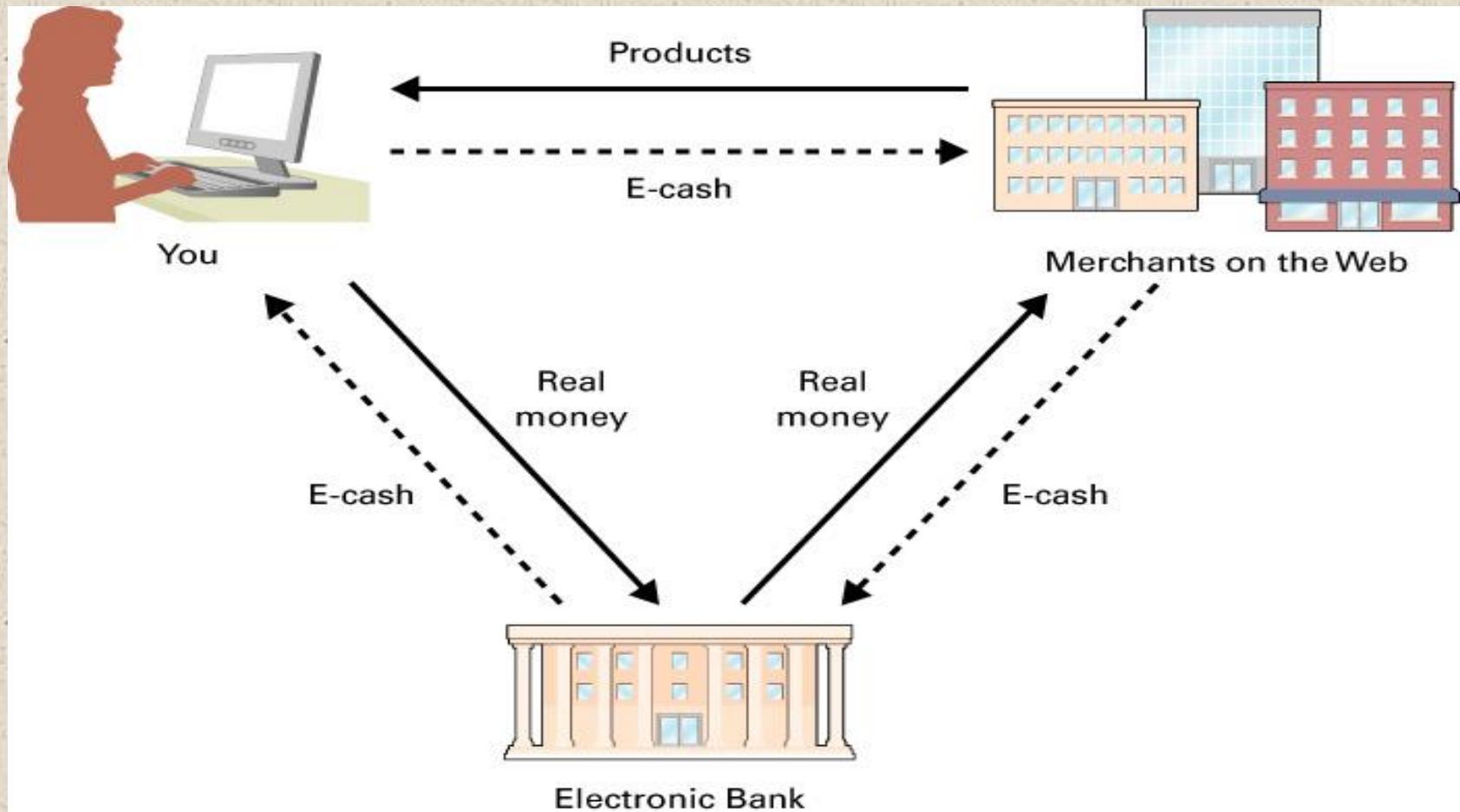
What's Holding Up E-Cash?

- Anyone can be an electronic bank
- There are no e-cash standards
- Merchants must have accounts with electronic banks
- E-cash makes money laundering easy
- E-cash is easy to lose, impossible to replace
- Biggest Drawback: Acceptance by the consumer market at large that e-cash is safe to use



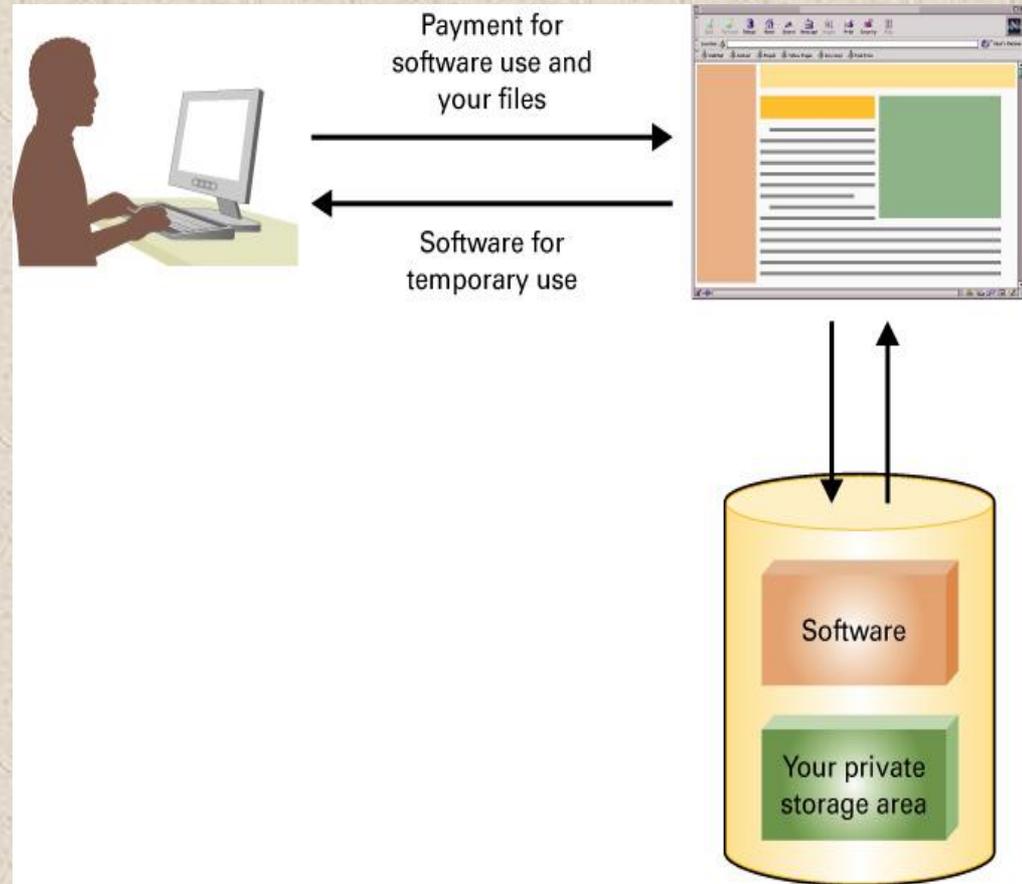
Using E-Cash on the Web

E-Cash Transaction



Renting Software from Application Service Providers

- Many companies are already planning for "pay-for-use" software over the Web
- May not need a disk drive in the future – even for Web-oriented devices



Personalization

- When a business knows so much about you that it can anticipate what you want or need and offer it to you
- This isn't spam
- You will receive personalized offerings that no one else will receive
- May be achieved with global positioning system (GPS) technology

Personalization or Spam?

- If your cell phone is GPS-enabled, can any organization track your movements?
- Is a push environment always better than a pull environment or will we need a combination of the two?

Push (Not Pull) Technologies

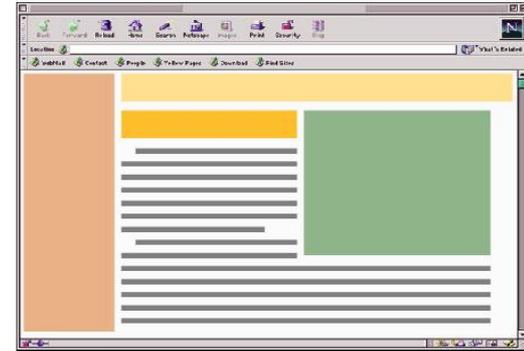
PULL TECHNOLOGY



Request for what
you want



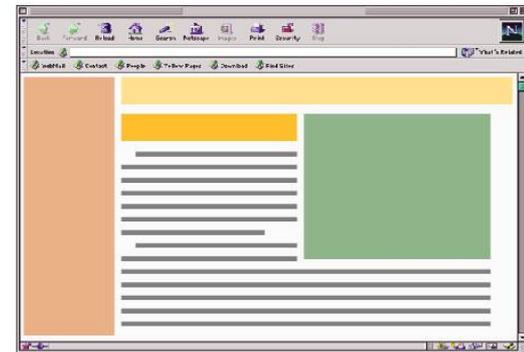
What you want



PUSH TECHNOLOGY



What you might want



Technology-Based Homes of the Future

- Wirelessly networked
- Part of the Internet
- Speech enabled
- Characterized by intelligent home appliances

Intelligent Home Appliances

Contain embedded computer technology that controls functions and makes decisions

- Smelling refrigerators
- Smart vacuum cleaners
- Dirt-sensing clothes washers

