

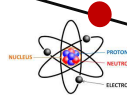
## ECE 101, Lecture 2: History, Map, and Keywords in Computing

Romit Roy Choudhury, Steve Lumetta, Abrita Chakravarty



## History, Map, and Keywords in Computing

Time

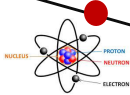


- We will travel through time:
- Starting from electricity and signals to today's self driving cars ...
- Our goal is to get a bird's eye-view of the whole course



## History, Map, and Keywords in Computing

Time



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- Starting from electricity and signals to today's self driving cars ...
- Our goal is to get a bird's eye-view of the whole course

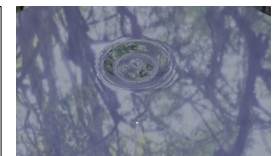
- We will meet the computer and the Internet ...
- And many other important milestones in the path
- So, let's get started.



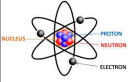
Time



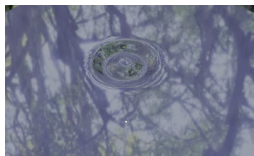
- Energy can be thought of traveling as waves - like ripples on water
- When you speak, your throat creates such ripples in the air
  - Your ear senses the air vibrations (your ear-hairs vibrate)
  - They in turn create another form of waves in your nerves
  - These are electro-magnetic signals that reaches your brain
  - You brain interprets the electricity as sound and speech



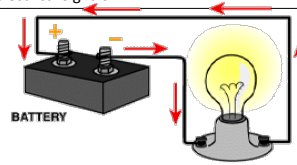
## Time




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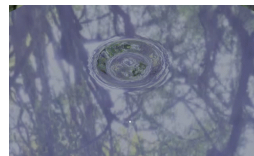
- You know about electricity flowing through wires ...
- Turns on light bulbs or charge your phones
- Electricity flowing through electronic devices called electrical signals



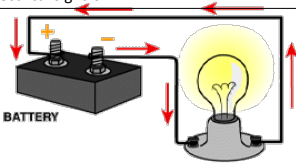
## Time



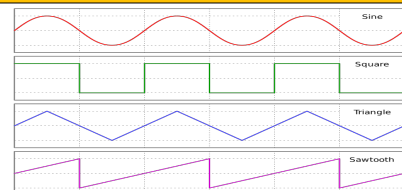
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- Henceforth, when we think of signals, let's picture this:



- From lecture #1, we wanted to express information as bits
- We understand the concept of bits ... but how do we physically realize them?

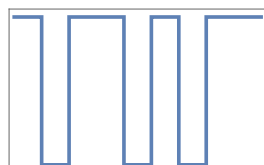
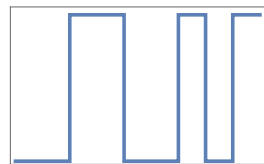
- So here is one idea:
- Let's express bits through signals

- Specifically:
  - To represent bit = 1 ... let signal be HIGH
  - To represent bit = 0 ... let signal be LOW

- So, now let's transmit the bit sequence: **1 0 1 1 0 1 1 1**

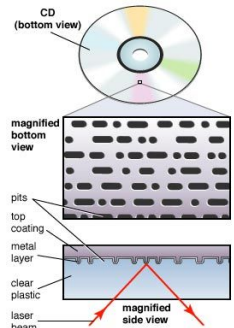
- Now suppose someone sends you this signal.

- What bit sequence is she communicating to you?

**Communicated bit sequence = 0 0 1 1 0 0 1 0 1**

- I know how to send bits ... but where do I store them?
- How about find some natural persisting shape that can be modified
  - Pretend some shape is Bit=0 and the modified shape is Bit=1
- Store the full bit sequence by modifying the natural shape
- That means you have "bit memory"



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  - Store the full bit sequence by modifying the natural shape
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CD (bottom view)

magnified bottom view

pits

top coating

metal layer

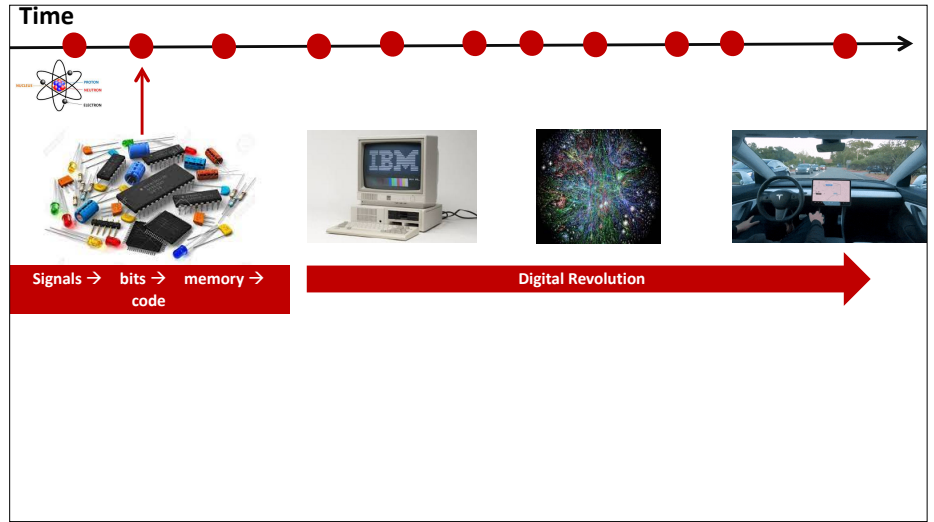
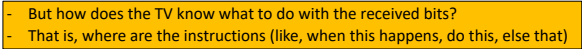
clear plastic

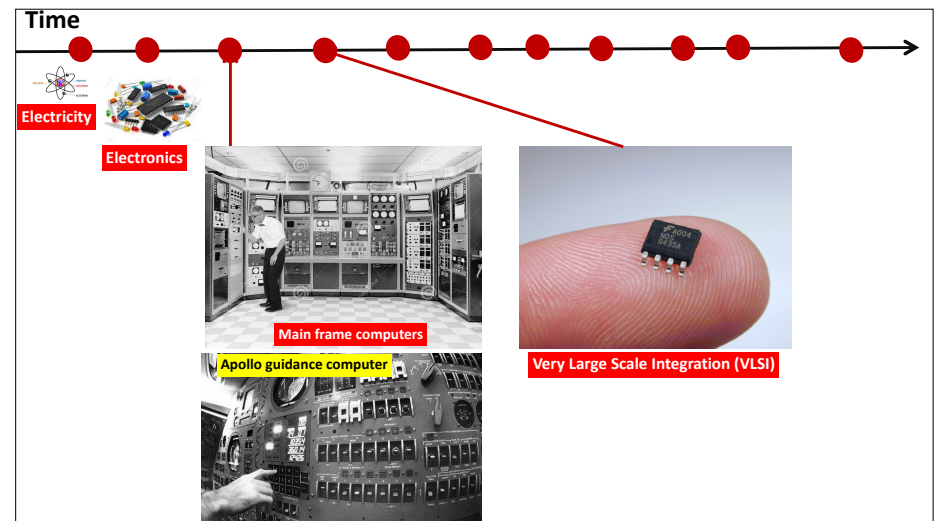
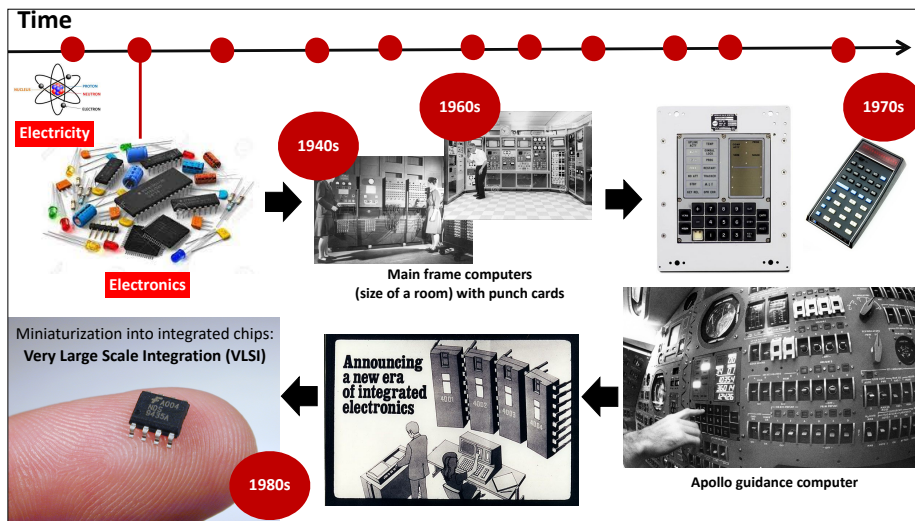
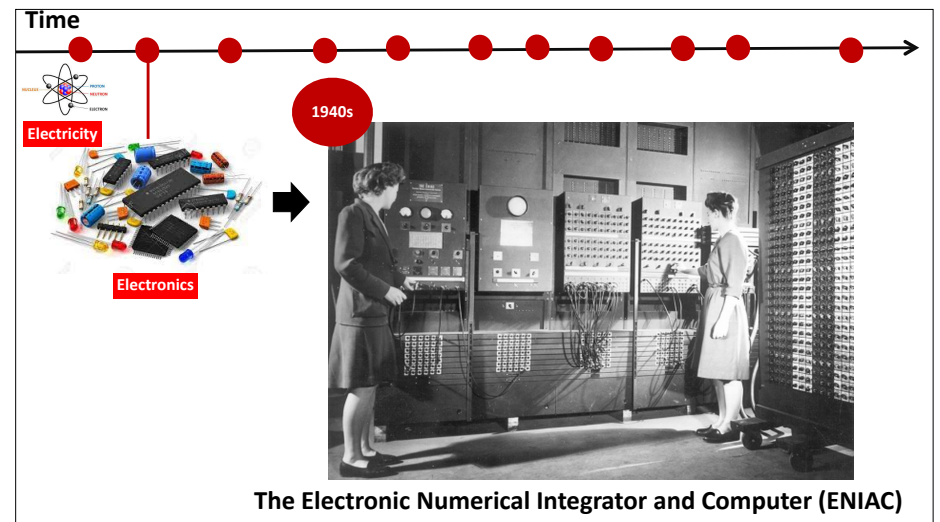
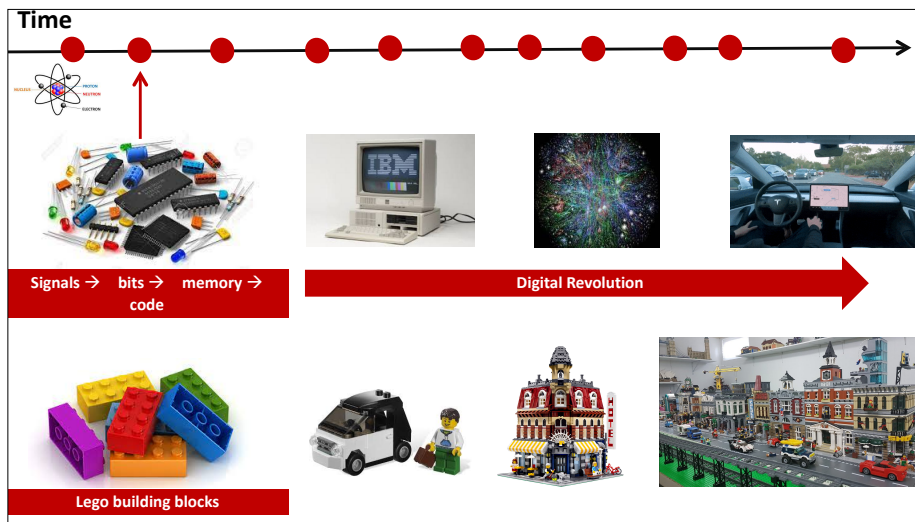
laser beam

magnified side view

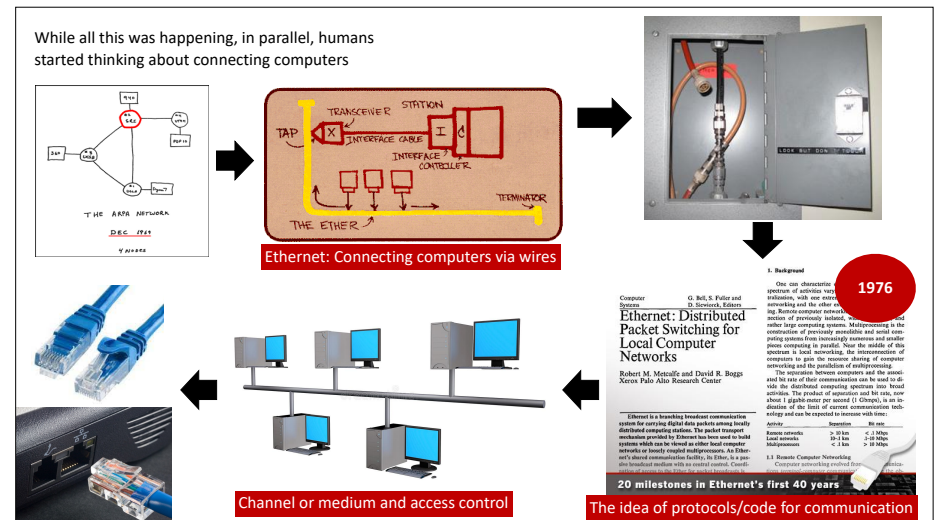
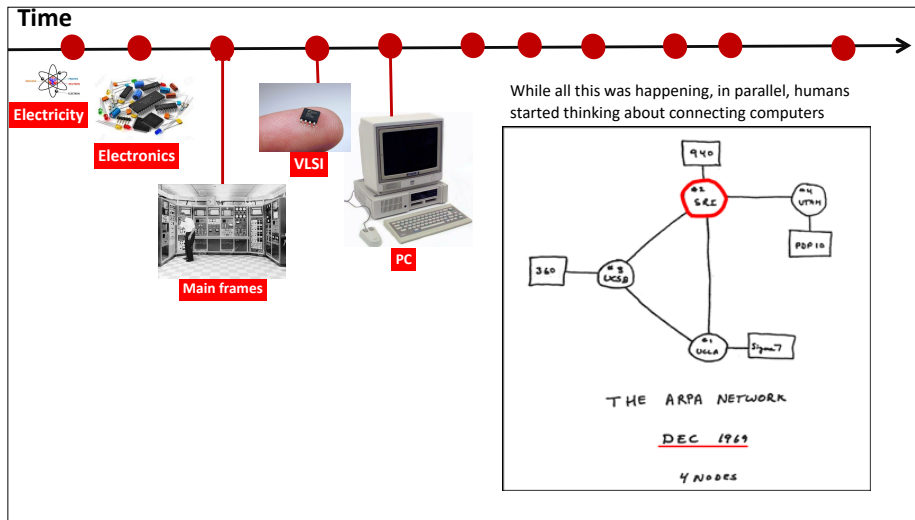
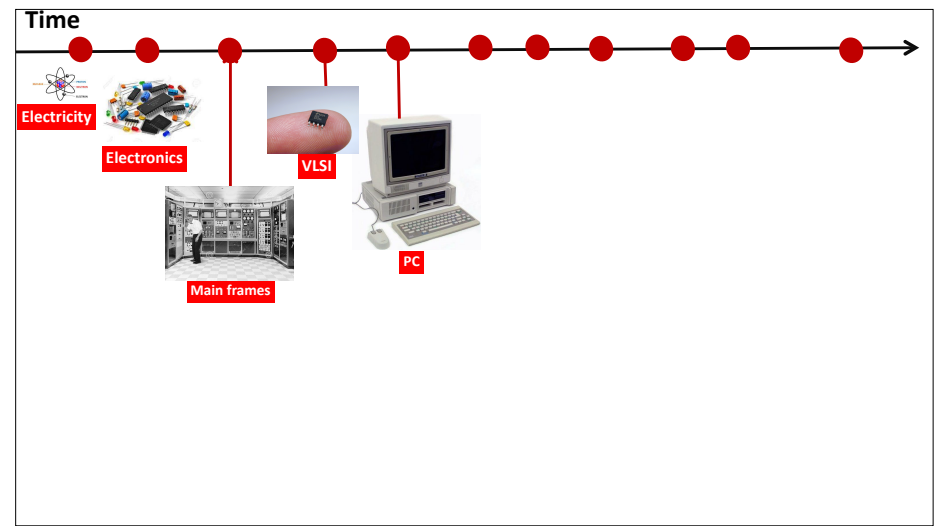
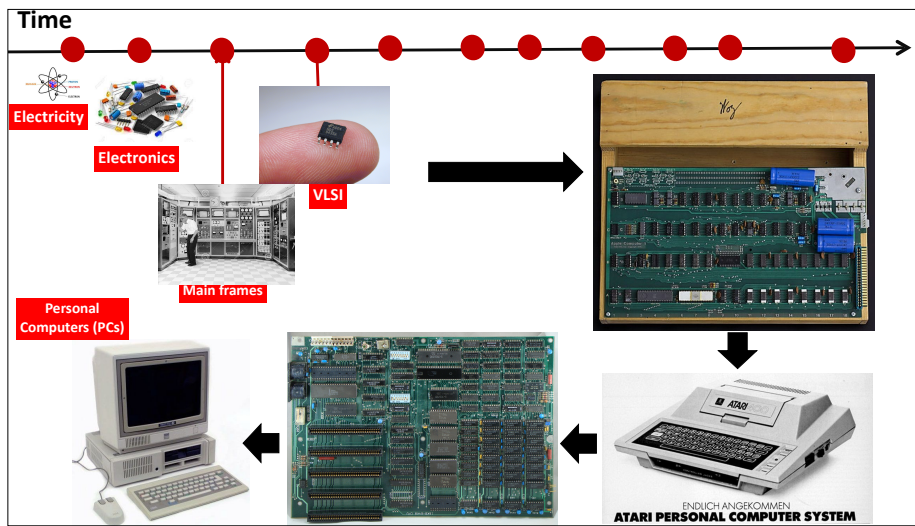
Communicated bit sequence = 0011010011

LG UHD TV



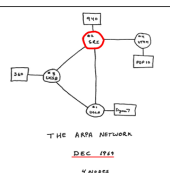




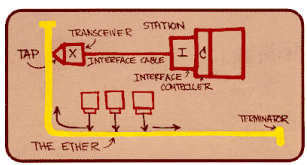


# But why stop at connecting few computers in a lab?



started thinking about connecting computers




THE ARPANET  
DEC 1971  
Y. YALOWITZ



**Ethernet: Connecting computers via wires**

**Channel or medium and access control**

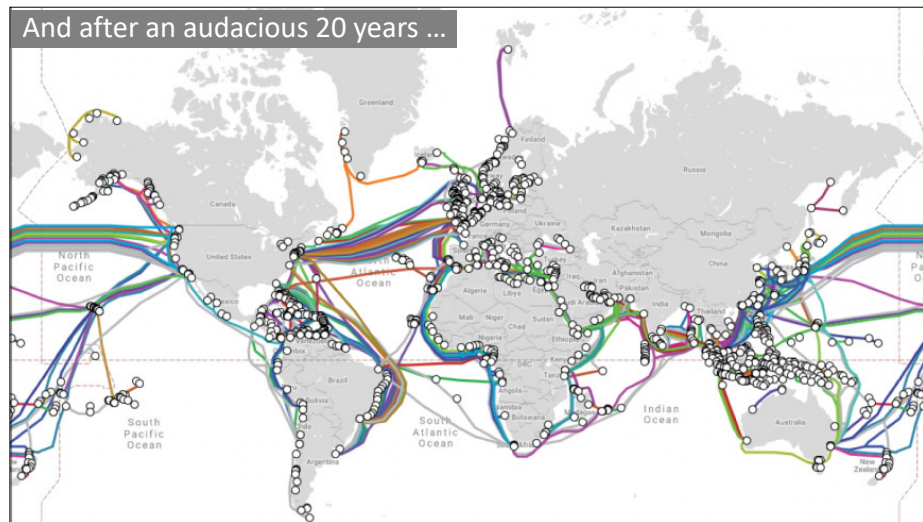


**1. Background**  
Computer  
G. Bal, S. Palu and  
D. J. S. Palu  
**Ethernet: Distributed  
Packet Switching for  
Local Computer  
Networks**  
Robert M. Metcalfe and David R. Boggs  
Xerox Palo Alto Research Center

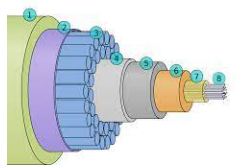
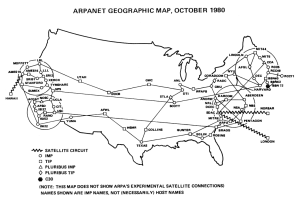
**1976**

**20 milestones in Ethernet's first 40 years**

**The idea of protocols/code for communication**



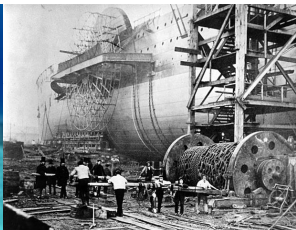
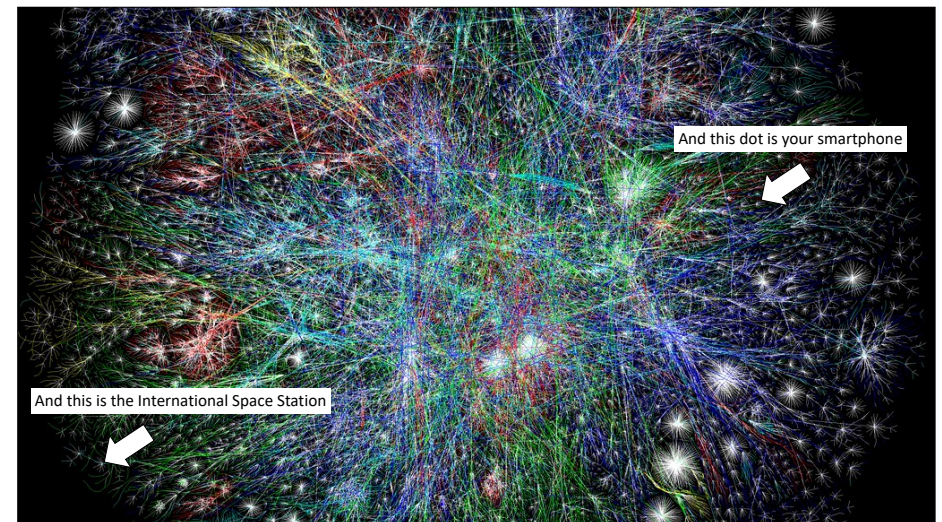


# But why stop at connecting few computers in a lab?

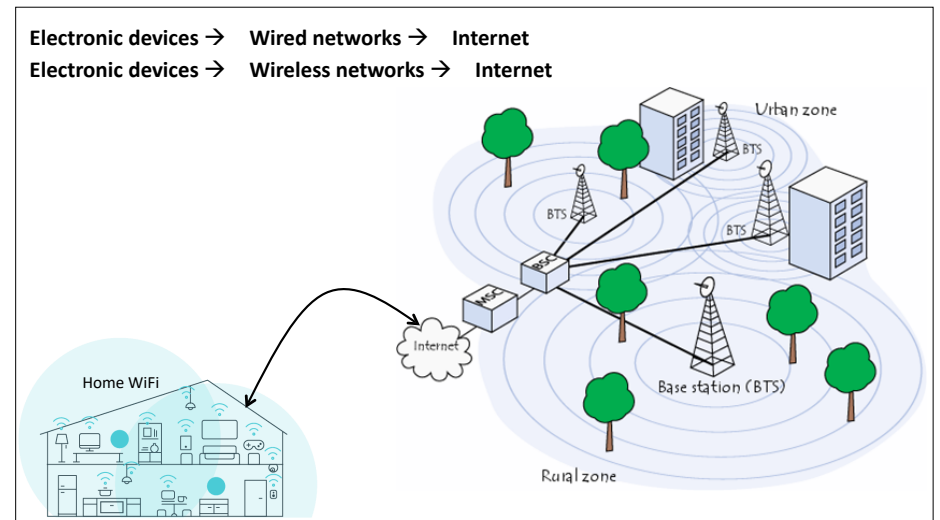
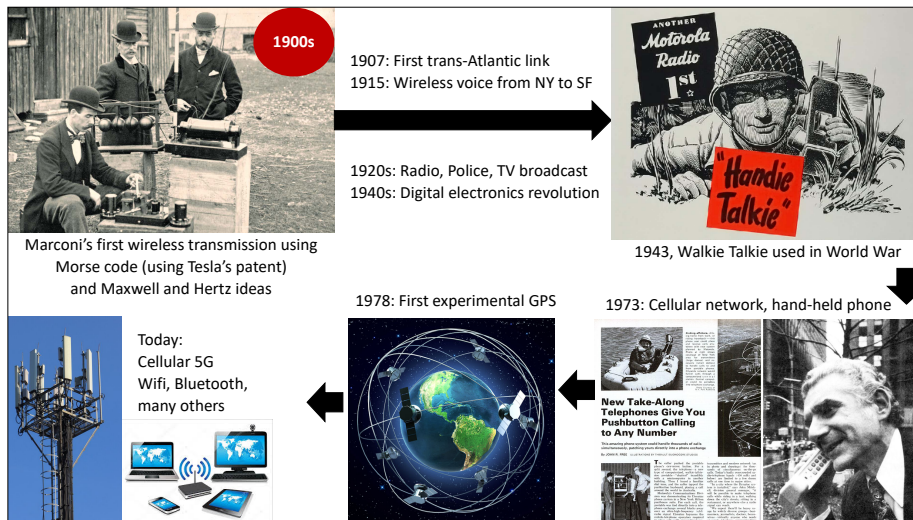
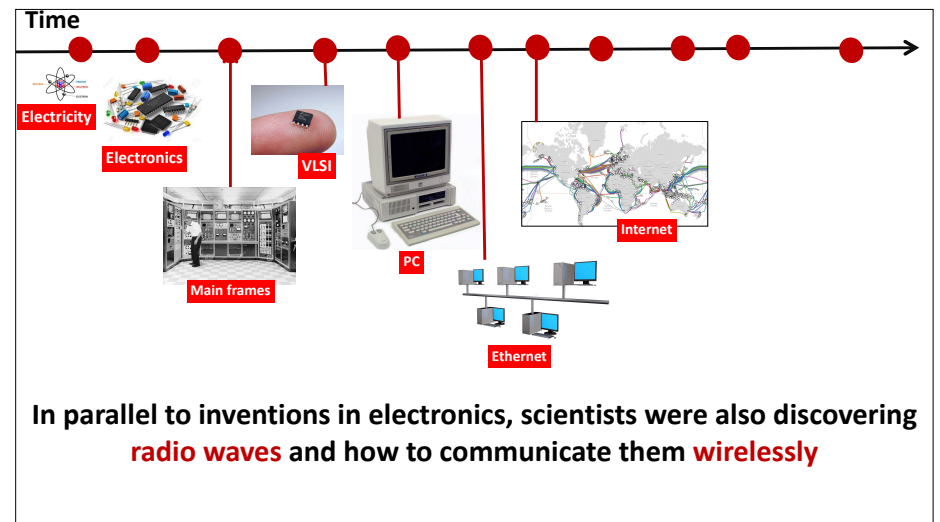
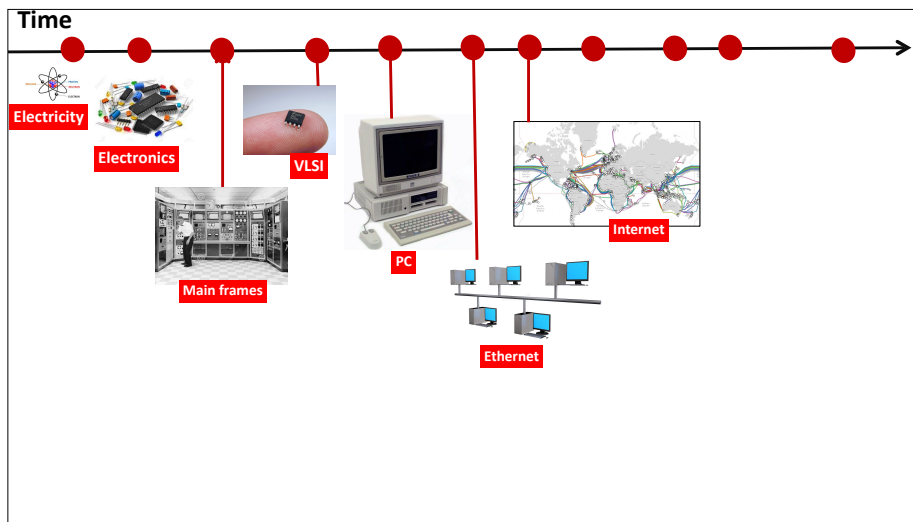



ARPANET GEOGRAPHIC MAP, OCTOBER 1980

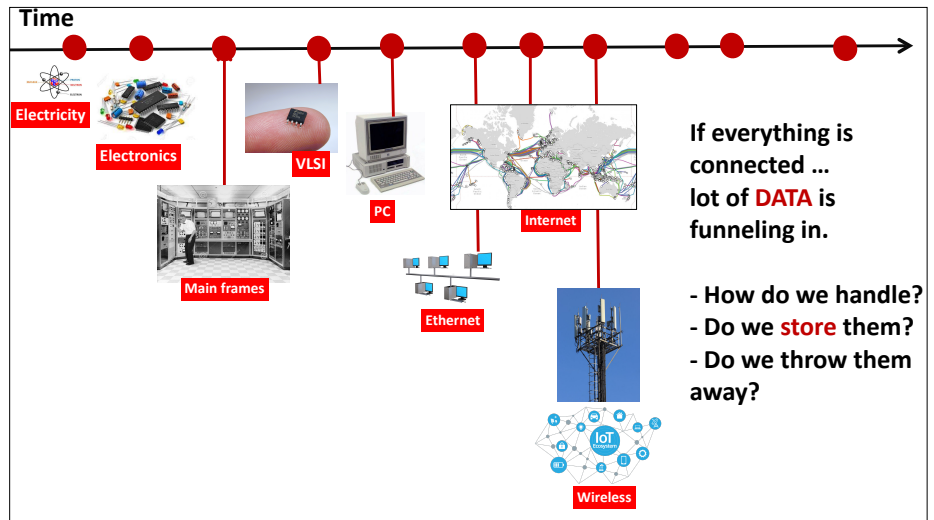
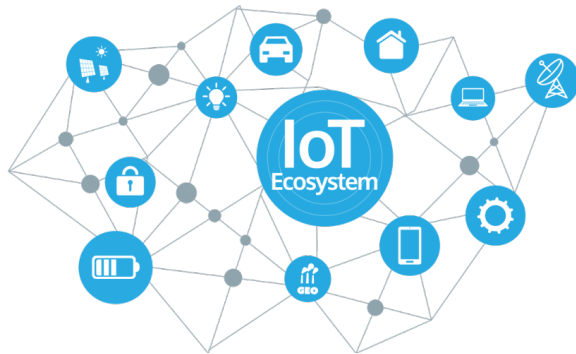
Application  
Transport  
Network  
Link  
Physical

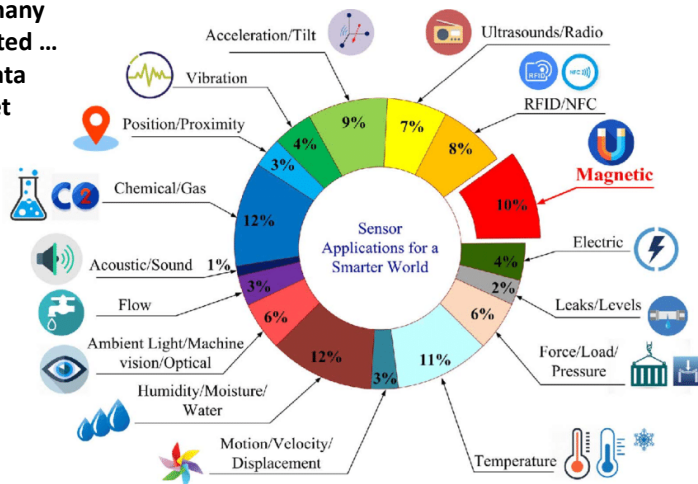




Electronic devices → Wired networks → Internet  
 Electronic devices → Wireless networks → Internet  
 Which means everything is connected via the Internet: Internet of Things (IoT)



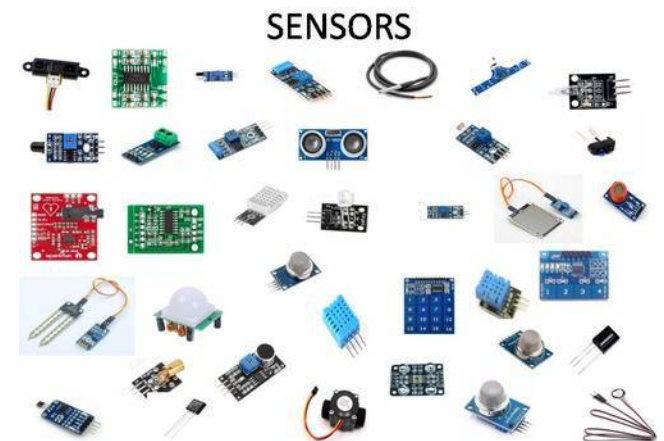
IOT has many many sensors connected ... all streaming data into the Internet

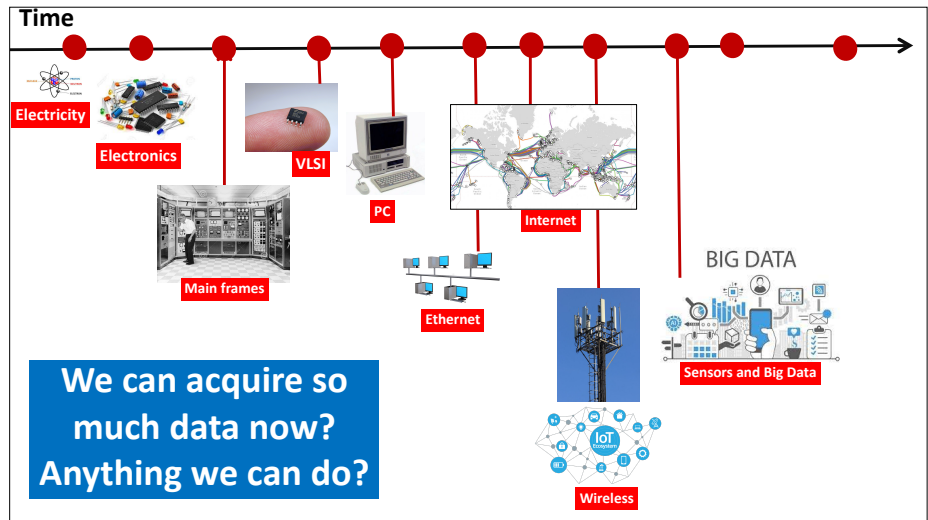
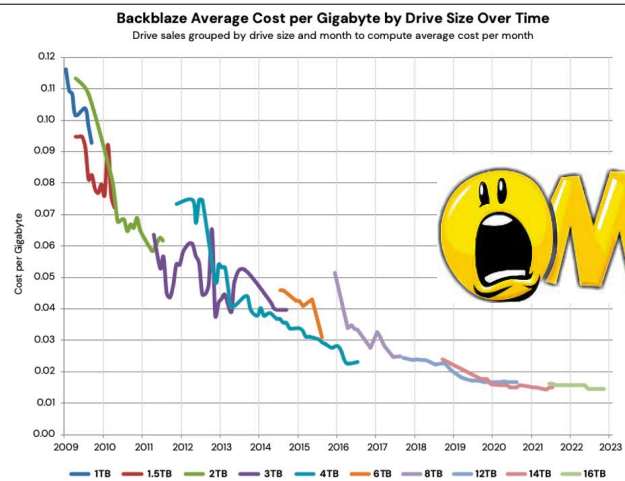
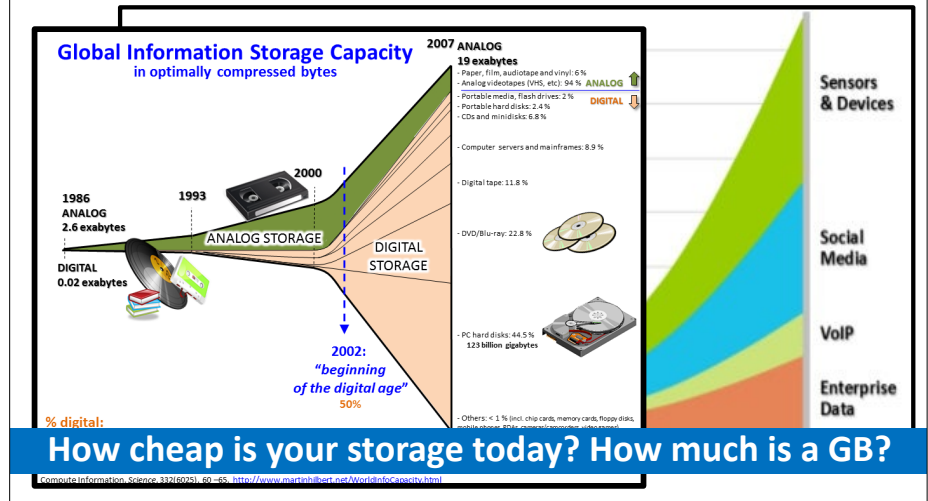
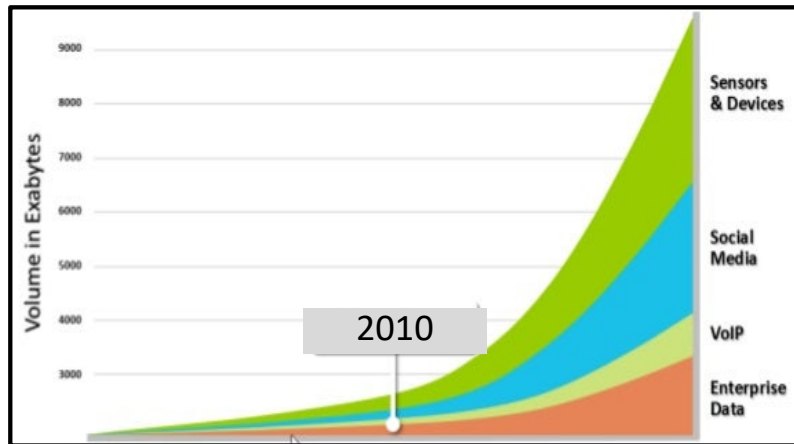


IOT has many many sensors connected ... all streaming data into the Internet

Again, VLSI and advance battery technology helping.

Wireless allowing sensed data to be sent to Internet







One idea: Can data help computers get smarter?  
Consider the task of a computer recognizing a face in a picture



How would you make the computer recognize a face?

Past approaches:  
Specify the rules to identify a face  
Make the computer look for these rules (or "Features")

Rules could be:

1. two symmetric black curves (eyebrows)
2. two black dots below the curves (iris)
3. two small dots close to the middle (nostrils)
- ...
1000. slight darkness below the chin (shadow)

Does this work?

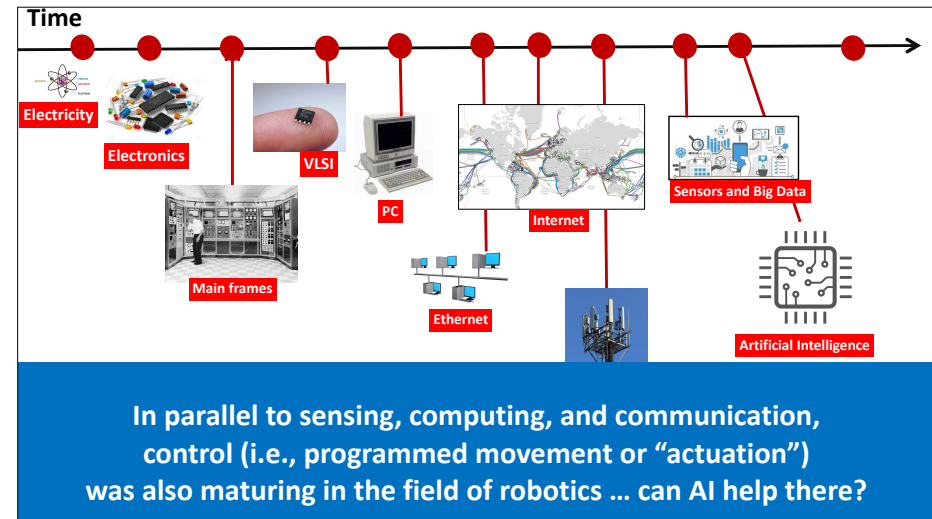
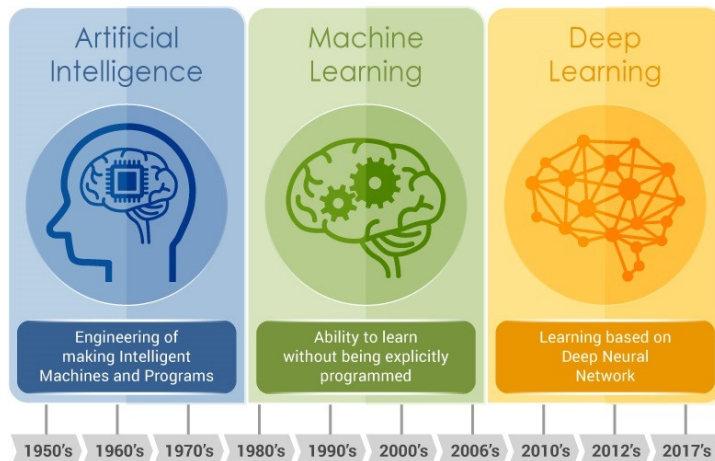
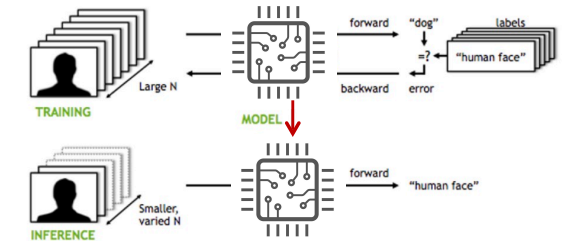
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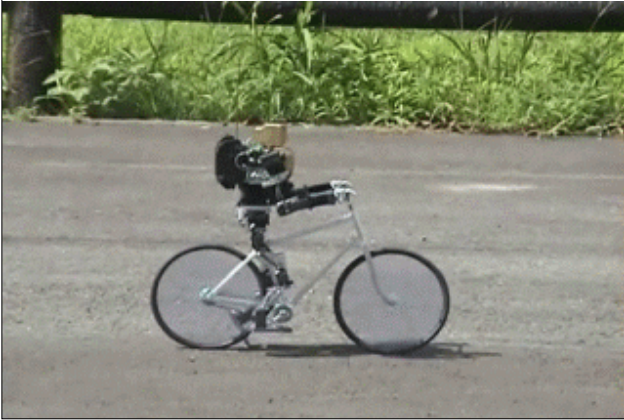
But say you have lots  
of facial pictures



1. Let the computer figure out which patterns are common across thousands or millions of faces (training data)
2. Remember those patterns (model)
3. When a new face picture (test data) comes, apply those patterns to check if it is a face. Output yes or no.



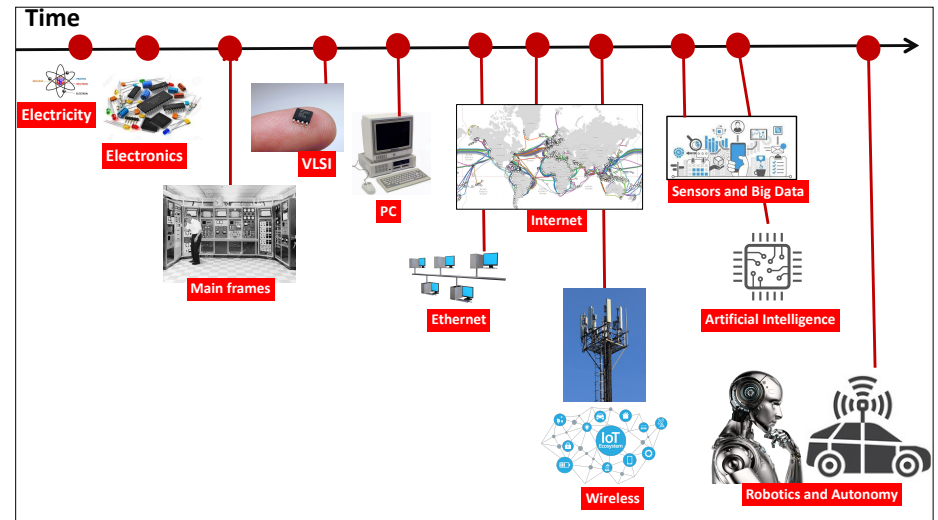
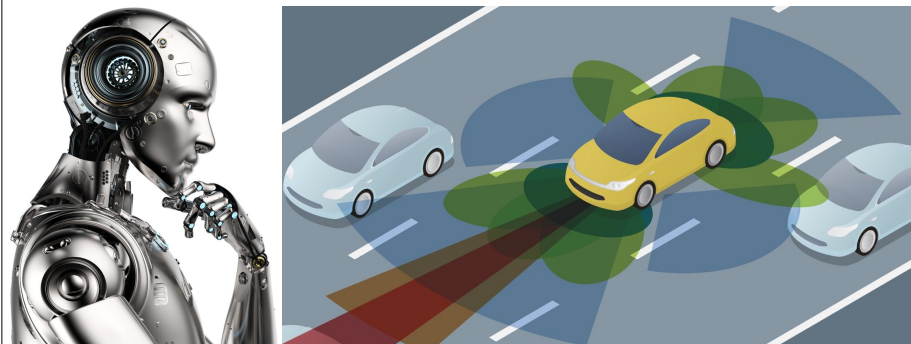
Yes, AI particularly effective when humans don't know why they do what they do (so its hard to teach a computer) ...



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And this is where we are today ... convergence of  
**Sense + Compute (AI) + Communicate + Control**  
using machines that can do things that we cannot explain.  
This is the new age of “autonomous systems”.



Of course, you are NOT supposed to remember all this ...

The goal was to show you the landscape for this ECE 101 course ...  
and why this could be exciting and relevant to students  
of all departments in the campus.

Questions? Comments?