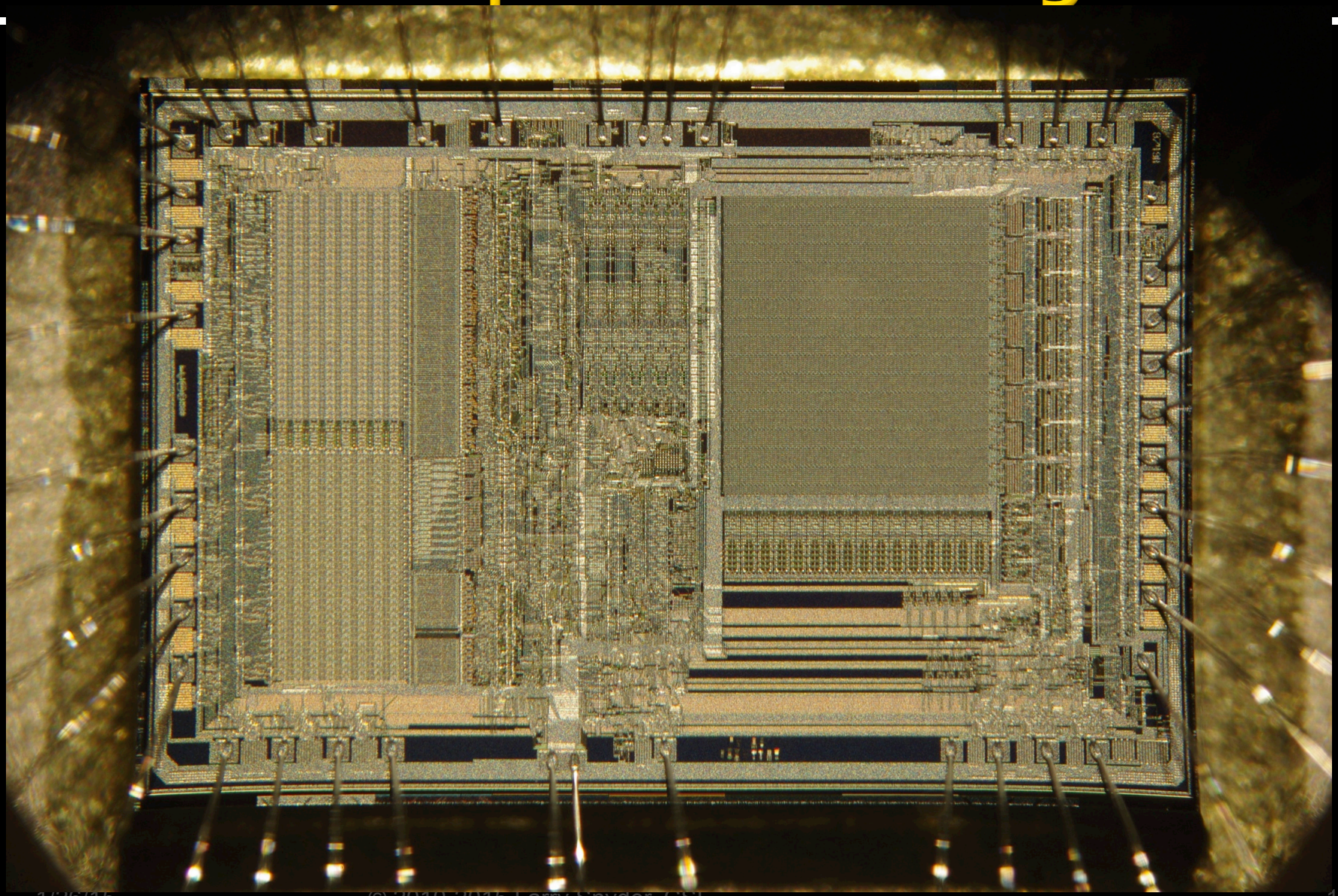
Entomb Chip Into A Package



Integrated Circuits == Big Win

- ICs solved the hand assembly problem by building the three kinds of parts (transistors, resistors, capacitors) together
- The parts are never "separate;" they are connected during fabrication by printing wires
- By printing the layers using photolithography, the complexity of the circuit becomes unimportant – the cost of simple and complex circuits is the same

Not (yet) Perfect

- Computers could now be cheap enough for everyone to have one … but people didn't really have anything they needed a computer for (so everyone thought!)
- Ken Olsen, Founder of Digital Equipment, "There is no reason for any individual to have a computer in their home [1977]"

Next Big Thing: Personal Computers

- Despite Apple attracting interest among geeks, people didn't buy personal computers until IBM offered one in 1982

Computing Comes To Everyone

- Regular folks – not just government, military, scientists, banks and companies – could now apply computers to their interests
- Created a demand for digital data: news, pics, audio, video, books, etc., causing old technologies to digitize rapidly. Now it matters to everyone if a machine can "read" it
- From about 1985 most "new" information has been digital
- Quickly, people acquired enormous amounts of information

Computers Are Versatile

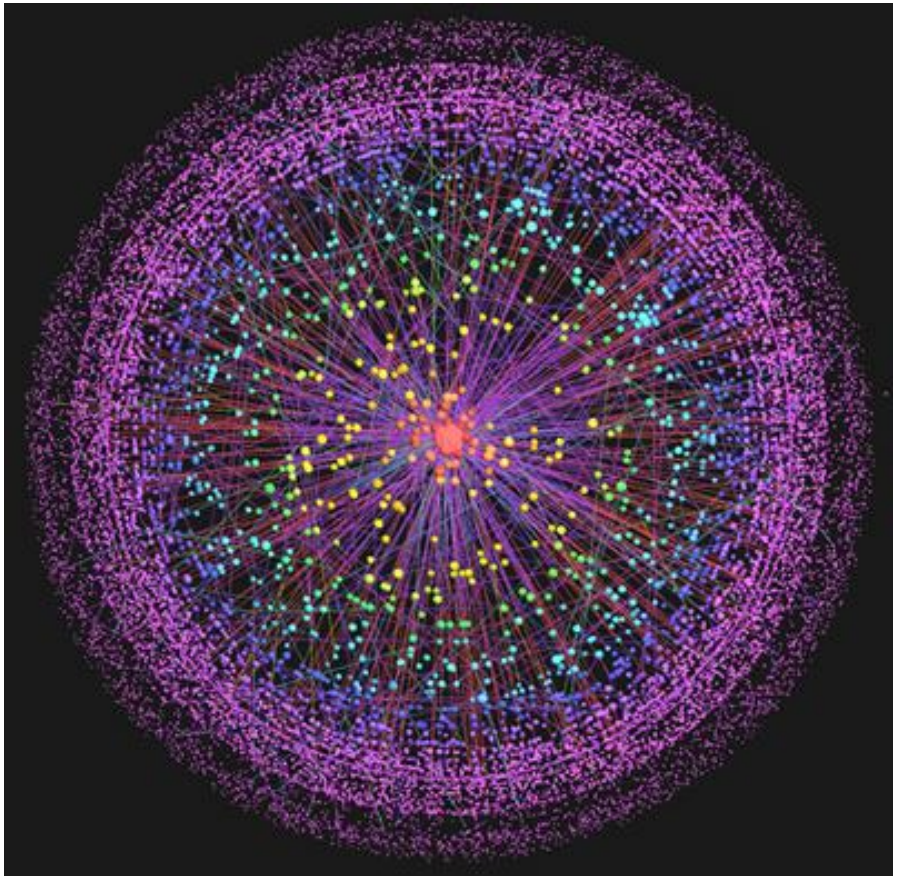
- The take-home message:
  - Cheap computers means they can be everywhere
  - Soft instructions mean every machine does many different things
- Therefore all of the focus is on the software

Not (yet) Perfect

- Stand alone computers are useful … connected computers are MUCH MORE useful!
- Actually, they're awesome!

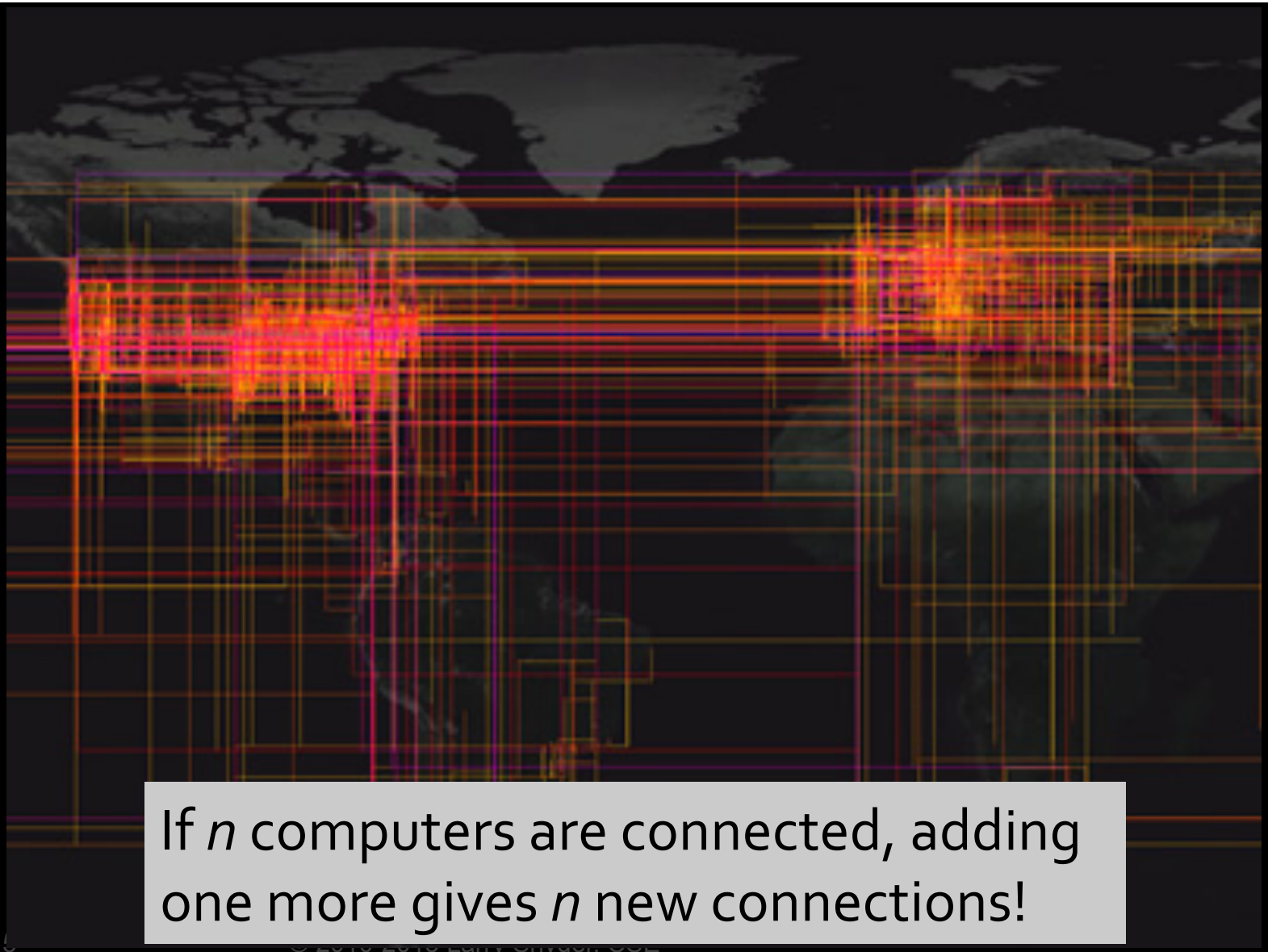
Next Big Thing: Internet

- Invented in 1969, it took almost 20 years to get out of the lab and into public consciousness



"On the Internet, nobody knows you're a dog."

Connectivity to Change the World



If *n* computers are connected, adding one more gives *n* new connections!

Internet Exploits Computers

- Like the post office, but unlike original phone system, the Internet is a general mechanism
  - The Internet transmits digital data in packets
  - Internet uses Domain Name Service System to locate destinations – fully automatic
  - Because digitization (encoding with 0, 1) can represent any information, the Internet can ship all digital information
  - Music, video, images, scientific data, business documents, advertising, …

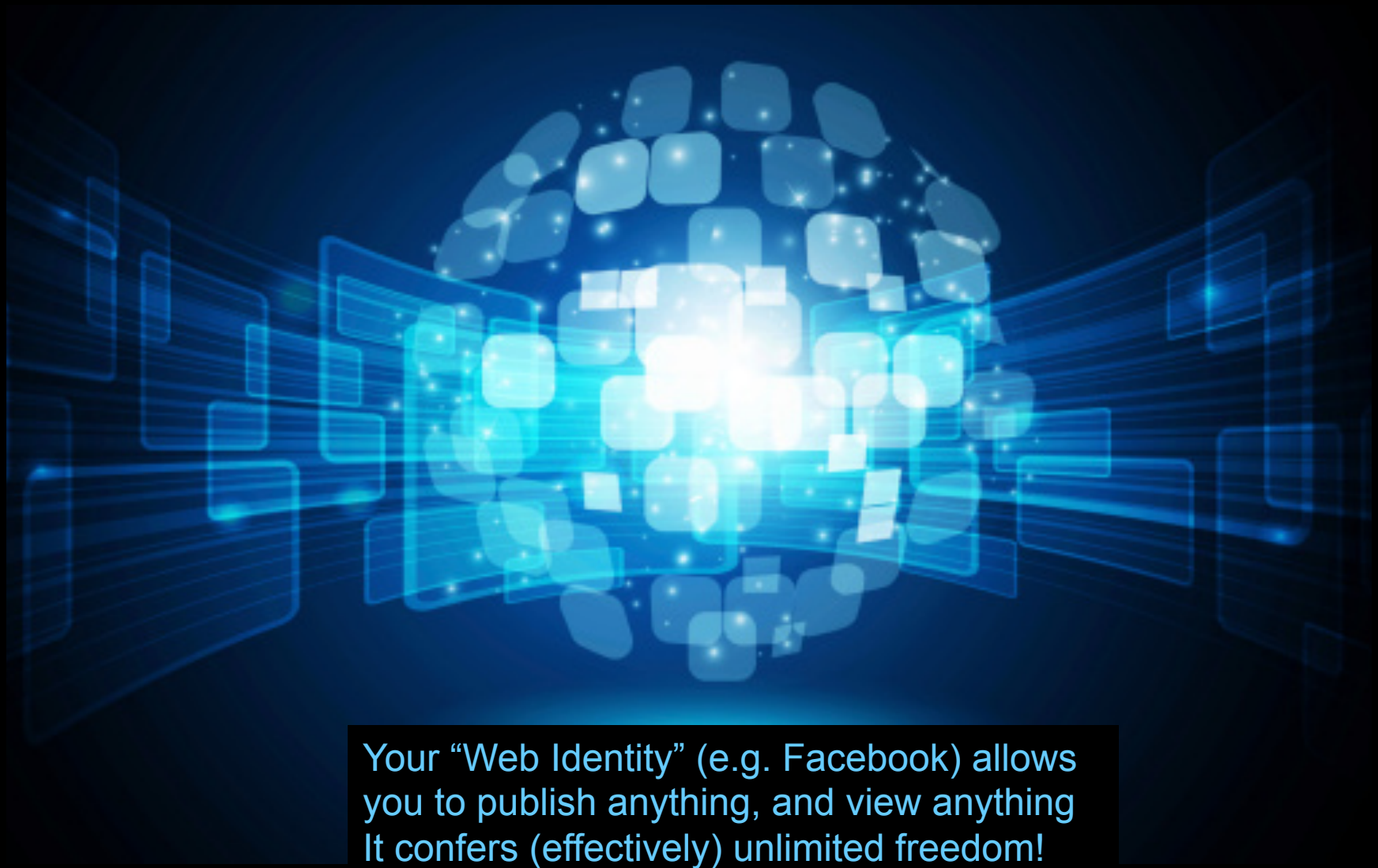
Not (yet) Perfect

- Moving data is great … having given computers the ability to communicate let's extend it to allow people to communicate

Next Big Idea: http

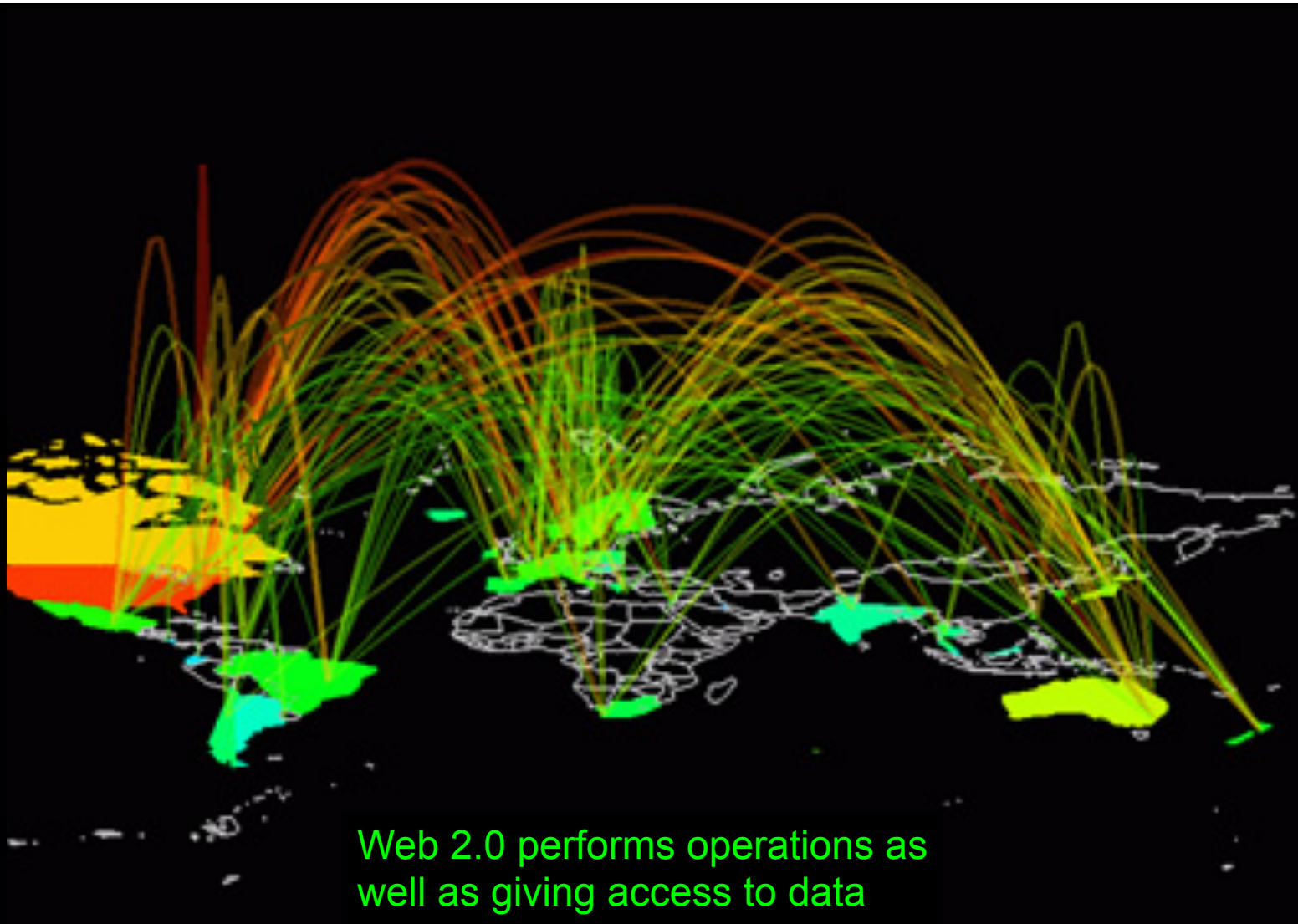
- All computers can "speak" a common language: hyper-text transfer protocol
- For once, all of the world's people – who don't speak the same natural language – have a surrogate that can "talk" to everyone else

Identity In A Virtual World



Your “Web Identity” (e.g. Facebook) allows you to publish anything, and view anything
It confers (effectively) unlimited freedom!

We've Arrived At Today



So … why were these important?

- What was Hollerith's contribution?
  - That helped, but there was a problem …
- What was ENIAC's contribution?
  - That helped, but there was still a problem …
- What was the transistor's contribution?
  - It helped, but there was still a problem …
- What was integrated circuit's contribution?
- What IC fab idea changed the world?
  - Computers were affordable, but problem remained

Importance … continued

- What effect from everyone having computer?
  - Computing was OK, but a problem remained …
- What was the contribution of the Internet?,
  - The Internet was great but a problem remained …
- What was the WWW's contribution?
  - The Web is great, but a problem remains …

In Summary

- Punch cards let hardwired machines do the work
- Computers are digital processing machines using "soft" instructions that are easily changed
- (Solid state) transistors have "no moving parts"
- Integrated circuits (ICs) make fab easy/cheap
- Photolithography allows ICs to be complex, too, enabling mind-bogglingly complex computers
- Networking – connecting computers is power
- WWW – unifies worlds with 1 protocol and access to "all" digital data