

15.561
Information Technology Essentials

Session 16
Emerging Technologies

Technology futures

- **Communications**
- **Input/Output**
- **Computing**

Communications

- **Bandwidth will get much, much cheaper and more available.**
 - More people will have more decision-making power in organizations.
 - Will videoconferencing be as good as being there?
- **Wireless will be increasingly important.**
- **There will never be enough bandwidth.**
 - ...or will there?

Input / Output

- **Human interfaces will improve, but less rapidly than some expect.**
 - Speech
 - Written natural language
 - Tangible interfaces
 - Electronic paper
 - Neural interfaces
- **Computers will be more capable of acting in the physical world.**
 - Vision
 - Robotics / Motion
 - Desktop fabs
 - RFID

Computing

- **Computers will be much, much faster and cheaper.**
 - Limits to current technologies?
 - » Quantum computing
 - » Nanotechnology
 - » DNA computing/ biological computing
- **Computers will be everywhere.**
 - Ubiquitous computing
 - Information appliances
 - Wearables
- **Computers will be smarter.**
 - Limits to artificial intelligence?

Kurzweil's predictions - 2009

- \$1K computer does 1 trillion calculations / second
- Computers embedded in clothes and jewelry.
- Most routine business transactions involve a human and a virtual personality
- Translating telephones are common
- Human musicians routinely jam with cybernetic musicians.

Kurzweil's predictions - 2019

- \$1K computer has approximately the computational capacity of a human brain.
- Computers are invisible and embedded everywhere.
- 3D virtual reality displays in glasses are primary way of communicating with people and accessing computer-generated information.
- All-encompassing virtual environments allow virtually any kind of interaction over any distance.
- Virtual personalities (e.g., teachers, lovers) are common.

Kurzweil's predictions - 2029

- **\$1K computer has approximately the computational capacity of 1000 human brains.**
- **Neural interfaces to computers have been perfected, and computational augmentation of human brains is available.**
- **Computers have read all available human literature.**
- **There is growing discussion about the legal rights of computers.**

Kurzweil's predictions - 2099

- **The number of software-based humans vastly exceeds the number of those using carbon-based neurons.**
- **Humans who do not use the enormous computational augmentations available cannot meaningfully participate in dialog with those who do.**
- **Life expectancy is no longer a viable term in relation to intelligent beings.**

Questions

- What do you think will happen?
- What do you think should happen?
- How will these things affect business?

Course wrap-up

Course outline

- **Technology**
 - Fundamentals (Little Man Computer, computer architecture)
 - Networks
 - Databases
 - Web technologies
 - Computer security / cryptography
- **Applications of technology**
 - Software development
 - Enterprise systems
 - Under the hood of a commercial web site
 - Systems that span enterprises
 - Business Intelligence (data mining, data warehousing)
 - Emerging technologies

Lessons

- 1. The details of hardware, software, and networks will change every year, but the fundamental concepts illustrated by the Little Man Computer will be important for a very long time.**
- 2. The Internet, and everything built upon it, depends on multiple layers of “protocols” with the packet-switched Internet Protocol layer playing a key role.**
- 3. Relational databases are the most common means of organizing and storing large amounts of data in organizations today. They can also be a powerful tool for data modeling and analysis in consulting, investment banking, etc.**

Lessons (cont.)

- 4. Software development is a key enabler or failure point in many organizations. Managing it well usually requires getting requirements feedback iteratively and adding appropriately-skilled staff early.**
- 5. As digital transactions become more common, every manager (and citizen) should understand their security risks and available countermeasures.**
- 6. The original Web model focused on presenting static information to human viewers. One of the most important trends in Web technologies today is the "semantic Web", which explicitly codes information about meaning as well as appearance. This will enable better searching, b2b integration, software agent applications, etc.**

A final lesson...

- 7. Every few years, computers will be able to support (or automate) more of the activities that go on in businesses. Therefore, some of the most important technology opportunities won't involve making new technologies, but in figuring out new ways to use technologies. Finding (and exploiting) the most promising of these new opportunities can give you significant advantages.**