Information Technology (IT) is changing how we work, solve problems, do business, communicate and interact.

**IT & Science — Goals**

- Understand the role of IT and Science in the changing Society.
- Be able to define Information
- Be able to define IT and give examples of how IT is used in science
- Understand where the Internet came from and when, and how it is important in IT
- Understand how the World Wide Web (WWW) operates
  - Explain the Client-Server Model
  - Understand the limitations of the Web

**Changing Societies...**

- **Agrarian to Industrial to Post-Modern Society**
  - Periods of social changes that resulted in a shift in the foundation of science away from acquisition of theoretical knowledge toward technological innovations.
- **Ecological Society**
  - emphasis on science and technology, and science education (in relation to human activities and interactions with the environment).
- **Technological and Information-Based Society**
  - greater emphasis on the integration of technology and science (i.e., Information Technology) into society
Science and Technology...

- Science allows us to understand the natural world in a systematic, empirical manner.
- Technology (as information technologies) provides the tools that allow us to do science.
- Science and technology function synergistically in a positive feedback to produce new knowledge (the impetus for IT)


IT Broadly Defined...

Information Technology is the study of how information is collected, manipulated, and delivered using a computer

But, what is Information?

Information...

Scenario 1:
- You plan to play tennis with a friend, but cannot leave your house because of heavy rain. Your friend calls and says that the game is off because it is raining
  - Is there any information in this message?
Information...

Scenario 2:
- You plan to play tennis on a court near your friend's house, which is several miles away, the sky is overcast. The night before the weatherman said that the chance of rain in the morning was high. Your friend calls and says the game is off because it is raining at her house.
  
  Does this message contain any information?

What is Information?

Scenario 1: You plan to play tennis with a friend, but cannot leave your house because of heavy rain. Your friend calls and cancels the game because it is raining.
  
  The message contains no information because you already know it is raining.

Scenario 2: You plan to play tennis on a court near your friend's house, which is several miles away, the sky is overcast. The night before the weatherman said that the chance of rain in the morning was high. Your friend calls and cancels the game because it is raining at her house.
  
  This message contains information because prior to receiving the message you were not certain whether or not it was raining at the tennis courts.

Information can be defined as anything that resolves uncertainty

IT Redefined...

- Any process, procedure, or technology that helps us to resolve uncertainty can be considered IT.

- IT, therefore, involves the integration (collection and manipulation) and transfer of information using networked computers
IT is a Cognitive Tool

- IT is a cognitive tool because it enhances powers of thinking, problem-solving, learning
  - Written language
  - Mathematical notation
  - Scientific method
- IT is a cognitive tool because it frames what is possible
- IT is a cognitive tool because it allows us to integrate information

Why is IT Important to me?

- Land-Grant (VT’s) Mission
- IT is a transforming agent (New Possibilities)
- Infusion of IT into our Society
- “I want a job someday”

Land Grant Mission...

To build a learning community dedicated to a wide access, independent learning, and new technologies that will deliver knowledge anytime, anywhere, and to nearly anyone.

- Morrill Act 1862
  - an act donating lands for Colleges of Agriculture and Mechanic Arts (the A&M system)
- Hatch Act 1887
  - provided for a network of agricultural experiment stations for scientific research.
- Morrill Act 1890
  - provided further endowment for colleges, particularly for institutions of black students (HBCUs)
- Smith-Lever Act 1914
  - created the Cooperative Extension Service, an educational outreach unit
New Possibilities: Bioinformatics

- The application of IT (computer technology) to the management (acquisition, storage, management, and analysis) of biological information.

- Specifically, it is the science of developing computer databases and algorithms to facilitate and expedite biological research, particularly in genomics (the study of genes and their function).

New Possibilities: Geospatial Tools

- Remote sensing, Geographic Information System (GIS), Global Positioning System (GPS), and geostatistics for scouting and diagnostic surveys.
IT’s Growth

IT’s growth can be measured by the growth of the Internet

Internet Hosts: 1995-2001

- Fastest growing technology ever
- >13,000,000 jobs
- 1st source for information

More Internet Stats....

- 513.41 million people online in August 2001 and >233 million hosts in January 2004
- >1.5 million web pages are developed daily
- 6 security incidences in 1988; 2412 in 1995 (Computer Emergency Response Coordination Center - http://www.cert.org/)
- >56% of drivers use only online directions and maps
- >63% of users get their news online only
- $1.5 trillion of US GDP in online commerce in 2002.

The Internet

A Tool for the Integration & Transfer of Information

- Some Internet Components:
  - The WWW
  - Email, FTP
  - Multimedia & Distance education
  - Internet chat rooms & Instant Messaging (IM)
  - Decision support systems
  - On-line shopping and banking...
Integration & Transfer

• Activities:
  - Designing dynamic HTML documents
  - Automating data collection and analysis
  - Building distributed information systems
  - Educating at a Distance

• IT fits the Land Grant Mission
  - Information discovery, synthesis, transfer, and application

History

“During my service in the United States Congress, I took the initiative in creating the Internet.”
— Al Gore’s interview with Wolf Blitzer, CNN, March 9, 1999

• Assignment!
  (History of the Internet and How it works)

- Internet was a military project, then an NSF project - Began in 1970s
  - Linking independent, equal computers through a network of Routers (IP)
  - Sending data transfer protocol (TCP - 1980s)

- WWW created in the 1990s
  - First effective multimedia format

The language of the WWW

• A new language, HTML, allowed a person to define how to mix images, text, and other media into a graphical display.

• HTTP (Hypertext Transfer Protocol) allowed computers to send HTML and other media across the Internet
Internet is Constantly Changing...

- At first, little formatting or interactivity
  - images were needed to make pages look good
- Improved formatting with:
  - tables, font tags, style sheets, and PDF
- Better Interactivity:
  - FORMS to Applets to JavaScript, PHP
- New software... (e.g., Macromedia Dreamweaver). Now anyone can develop web pages.

How IT Works...

- The Client-Server Model
  - Paired software applications running on your personal computer and on a remote server
  - Which is which?
- Clients you know about...
  - Web browsers
  - Email program
  - FTP

Client-Server & the Web

Create/Edit a File
WYSIWYG or Text Editor
View a Local File
Browser

Server

Move files to and from Server
FTP

Retrieve and View a Web Page via a URL
Browser
Getting what you want…the URL

- protocol://server.ip.address/path/filename.extension
  - Examples:
- Protocols: http, https, ftp, file, telnet
- IP Address: 128.173.55.28 is www.ento.vt.edu
- File extension tells the type of file: HTML, GIF, MOV

Client-Server & the Web

- Platform-dependent
- Single-user
- Run when needed
- Converts user’s commands to server using platform-independent commands protocols
- Displays Information

- Respond to platform-independent protocols
- Always on (up)
- Respond to MANY users at once
- Can, but do not generally display information
Limitation of the WWW...

- **Security**
  - See the Computer Emergency Response Coordination Center web site - [http://www.cert.org/](http://www.cert.org/).

- **Noise:**
  - any entity outside of the message that diminishes the integrity of the communication, and, possibly, distort the message for the receiver.
  - Noise reduces the quality of the information.
  - An example of noise in communication is the static in a TV receiver signal.

Summary

- IT is transforming not only how we communicate, but also how we think about and solve problems (i.e., how we do science)

- Modern IT is centered around computing technologies and the Internet