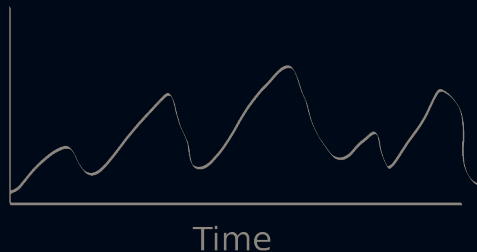# INTRODUCTION and HISTORY

Digital in the context of computation

- Digital
  - The storage of information as a *sequence* belonging to a set of discrete values
    - Discrete means individually separate and distinct

Comparison of Analog Signal to Digital Signal

Time

Time

- Possesses the unique quality of easy reproduction
- Example: Binary system
  - sequences of 0s and 1s are used to express the information
- Word origin
  - The root *digit* indicates a numeral between 0 and 9
  - Comes from the Latin *digitus*, meaning finger or toe
- Counting in daily life was originally done using your fingers and your toes

Digital Revolution

- Digital revolution: the morphing of human societies through an increased use of computational devices and systems
  - Learning
  - Goods production
  - Farming
  - Security

- Social interaction
- Entertainment
  - A continuation of the process of increased human reliance on technology and automation

Data Processing

- Data Processing: an application of the input-processing-output cycle
  - Input: data is collected either by a human recorder or an electronic sensor
  - Processing: The data is processed and analyzed according to the desired algorithms
  - Output: Results are displayed and or printed
  - Vital activity in the areas of business, medicine and research
  - The first era of computational history
    - 1940s to the 1970s
- Digital computers used for data processing
  - Developed during WWII for military use
  - Massive and expensive

- ▪ Acquired only by governments, large corporations, and research facilities
- ○ Data stored on magnetic tapes
- ○ Operated by trained technicians
- ○ Often very specific in function and use
- ○ Headless main computer
  - ▪ Interaction occurred via a secondary connection using the keyboard and terminal display
- ○ Performed centralized computing
  - ▪ All data is held and processed by the main computer, but data is entered and displayed from multiple terminal connections (as many as the system allows)
  - ▪ Data display, printing and storage were connected via cables to the main computer
  - ▪ Primary technology model during the early years of computation
- ○ Very limited public accessibility
  - ▪ Factors included
    - • Size
    - • Terminal interface and data entry

- ○ Used punch cards
  - Specialization

Personal Computing

- Historical background
  - ○ Digital devices go on the public market in the 1970s
    - ▪ Calculators and watches
  - ○ Personal computers become available in 1976
    - ▪ Initial sales were slow due to limited software availability
- Personal computing: Use of a standalone computer powered by local software
  - ○ Local software: code that is kept on a computer's storage device
  - ○ Marks the second phase of the digital revolution
    - ▪ 1975-1995

○ Seemed to set the power of computation in the hands of the masses
  ▪ Massed computer-use did not occur because of the limited connectivity

Network Computing

- Third phase of the digital revolution
- Computer network: a decentralized linking of computational devices that share data and the results of individual computations to achieve either a collective result or individual communications
  ○ Marked by running of software on local machines and then sharing the results with other machines
  ○ Existed before the Internet
    ▪ Communication feature of business and educational establishments
    ▪ Bespoke creations

- ▪ Complicated and unreliable
- Internet: global computer network
  - ◦ Rooted in military research
  - ◦ Transferred to the National Science Foundation (NSF) for further development and refinement
  - ◦ Becomes commercialized in the early 1990s
- Web: the entire repository of data that can be accessed via the Internet
  - ◦ Short for the *World Wide Web*
  - ◦ The data that the Internet operates on, shares and adds to
- Markers of the computational era from 1995 to 2010
  - ◦ Increased use of laptops vs. tower/desk computers
  - ◦ Sophisticated but general purpose/use case software bundles
    - ▪ Attempting to meet the needs of many customers with one package
  - ◦ Tethered Internet connections

○ Marked rise in and establishment of online social activities
- Asynchronous communications
  - Email
  - Forums and chat rooms
- Synchronous communication
  - Voice and video conferencing
- Entertainment
  - Online multiplayer gaming
  - Music sharing

Cloud Computing

- Cloud computing: the storage and use of Web-based data and software in an interconnected system of computers and communication devices such that individual users interact with

multiple computers at any given time and do not rely solely on the abilities of individual computers.

- Only a display device with minimal graphics capabilities are necessary to access the computational powers of the cloud
- Bears similarities to centralized computing, but doesn't require the resources of a single computer
- Leads to convergence: the ability of a single computational device to function in multiple capacities
  - The electronic equivalent of a multi-tool
  - Functions include:
    - Location and navigation
    - Time management
    - Communication
    - Education

- Entertainment
- Data recording and sharing

Current State of Computation

- Web 2.0: The shifting of the balance of Web data away from commercially-generated content towards user-generated content
  - Created for and spread through social media networks
    - Video sharing
    - Image sharing
    - Textual
    - Auditory
    - VR
  - Characterized (in the extreme) by hyperactive communication of information

- Allows for constant creation and spread of "viral" content
  - Lack of central control increases the likelihood of mob mentality and group think, but also allows for the flowering of individual freedom, shedding light on evil, and more robust discussion of ideas
  - The sheer mass of disclosed information can pose a security risk
    - Presents a radical redefinition of private vs. public
  - Morphing interpersonal communications
    - Individuals can present an increased sense of self or greater expression of individuality than was previously realized in conventional interactions (IRL)
- Internet of Things: the transformation of all electronically controlled devices into data transmitters and receivers that maintain a constant flow of information to and from the Web
  - The complete expression of humanity's control over its environment: a maintenance of physical (bio-chemical) homeostasis through electro-mechanical intervention.