Health Care Information Systems

Health Care Information Systems: A Practical Approach for Health Care Management
Karen A. Wager I Frances Wickham Lee I John P. Glaser

Hye-Chung Kum (kum@tamu.edu)
Associate Professor
Population Informatics Lab (https://pinformatics.org/)
Course URL: http://pinformatics.org/phpm631

PUBLIC HEALTH TEXAS A&M UNIVERSITY

POPULATION INFORMATICS

4

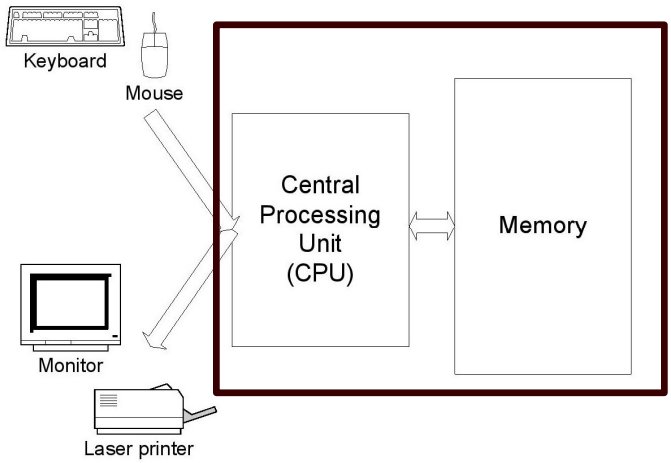
4

What is a computer?

- What are the important components?
- What does it do?

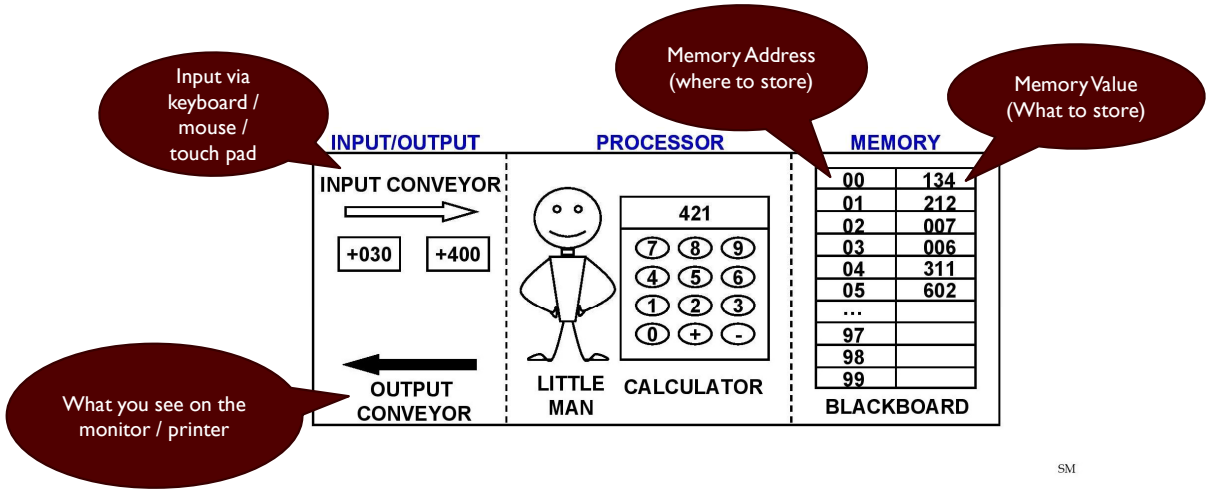
5

A Typical Computer



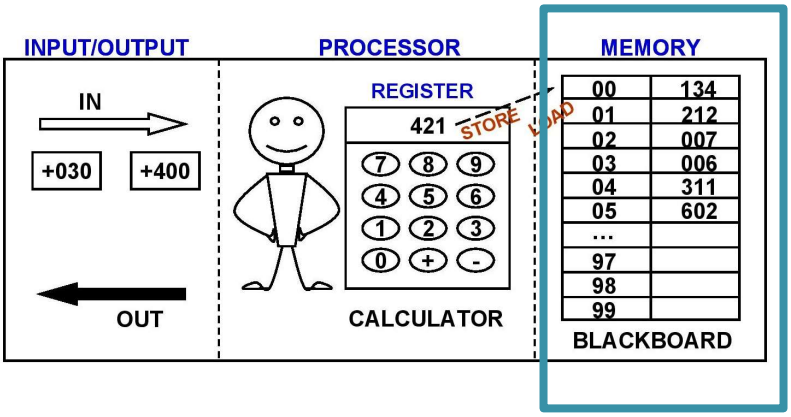
6

A Simplified Computer



7

A Simplified Computer

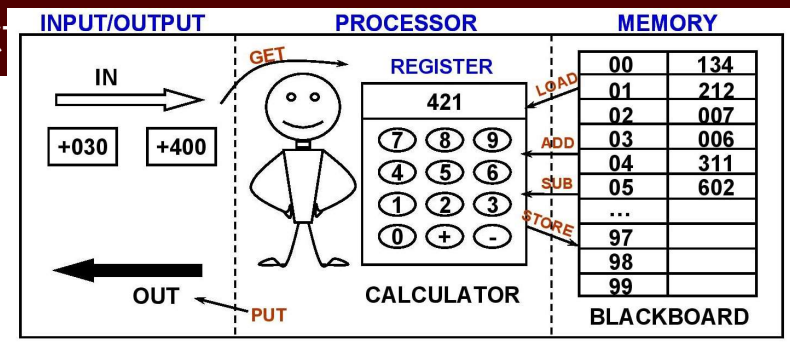


Memory

- There are 100 "locations" on the blackboard
- Each location has room for one 3-digit number
- LOAD moves number from blackboard to register. Example: LOAD 01
- STORE moves number from register to blackboard. Example: STORE 00

8

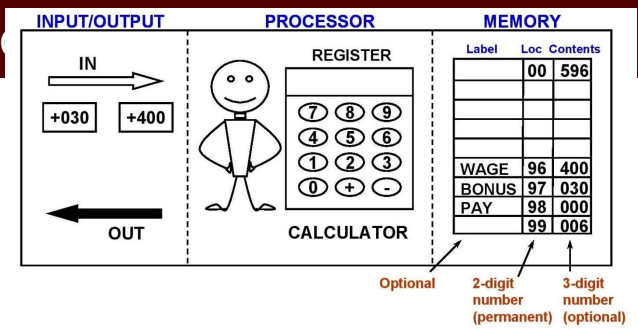
LMC INSTRUC



1. Get
2. Put
3. Load x (Load 01)
4. Store x (Store 05)
5. Add x (Add 02)
6. Sub x (Sub 03)
7. Stop

9

SYMBOLIC LM



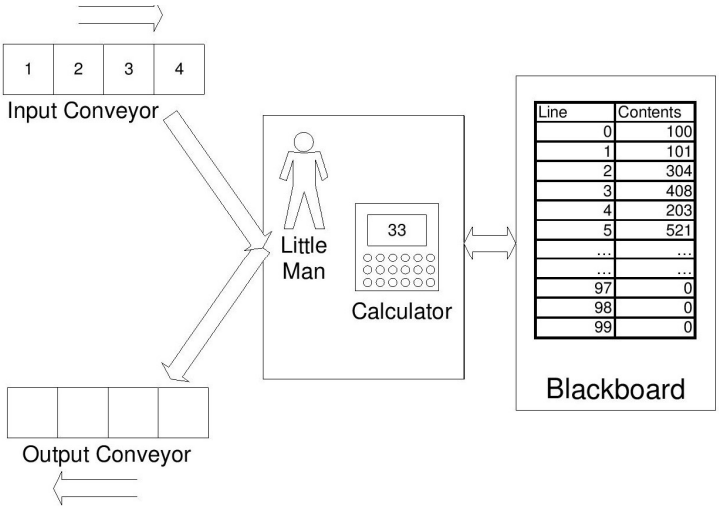
Software: Example Instruction Sequence

Calculate Pay = Wage + Bonus

1. Load Wage
2. Add Bonus
3. Store Pay
4. Stop

10

The Little Man Computer



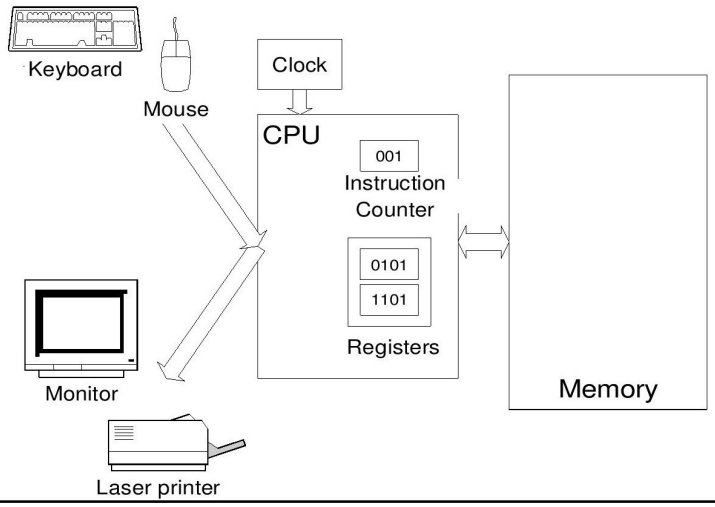
11

Basic Facts to Ask About Any Computer LMC Answers

- MEMORY
  - BASIC UNIT: 3 DECIMAL DIGIT NUMBER
  - MAXIMUM SIZE: 100 LOCATIONS
- REGISTERS
  - HOW MANY: 1
  - NUMBERS: 3 DECIMAL DIGIT NUMBER
- INSTRUCTIONS
  - NUMBER: 7 INSTRUCTIONS

12

The 'Real' Computer



13

INTEL PENTIUM 4 ANSWERS

- MEMORY
  - BASIC UNIT 8 BINATY DIGITS (BITS) = 1 BYTE
  - MAXIMUM SIZE 32 BITS = 4 BYTES
  - TYPICAL SIZE MEMORY RAM: 128 MB – 1GB
- REGISTERS
  - HOW MANY ABOUT 50 REGISTERS
  - NUMBERS VARIOUS TYPES
- INSTRUCTIONS
  - NUMBER ABOUT 500

14

Summary: A modern PC (2005)

- Processor: Pentium (500 MHz - GHz)
- Main Memory: 64 MB – 4GB
- Floppy Drive: 1.44 MB (3.5-inch disks)
- Hard Drive 10 – 500 GB
- Graphics: 640 x 480 – 2048 x 1536, 256 to 16 million colors
- Video Memory: 32 – 256 MB

15

Summary: A modern PC (2015)

- Processor: i5, i7 (1.8 GHz, 2.4GHz)
- Main Memory: 4 GB – 32GB
- External Storage
  - Removable storage: Thumb drive
  - Cloud storage: dropbox, google drive, MS onedrive
- Internal Storage: 500 GB – 4 TB
  - Solid state disk (SSD)
- Graphics: full HD – 4K display (4096 x 2160), 256 to 16 million colors
  - A single graphics card support: 1-6 display
- Video Memory: 32MB – 4/6 GB
  - dual graphics card

16

Computers …

- Every few years,
  - computers will be able to support (or automate) more of the activities that go on in business.
  - 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
- Computer Systems can be
  - FAST, CHEAP, or RELIABLE
  - Choose any two

17

Learning Objectives

- Identify the major types of administrative and clinical information systems used in health care
- Give a brief explanation of the history and evolution of health care information systems
- Discuss the key functions and capabilities of electronic health record systems and current adoption rates in hospitals, physician practices and other settings
- Describe the use and adoption of personal health records and patient portals
- Discuss current issues pertaining to the use of HCIS systems including interoperability, usability, and health IT safety

18

Outline

- Administrative v. clinical information systems
- Brief history of health care information systems
- Electronic (EHR) and personal (PHR) health records
- EHR adoption rates
- Value of EHR systems
- Key issues related to EHR systems

19

19

Definitions

- Information System (IS)
  - Data/information, processes, people, & IT
- Information Technology (IT)
  - HW, SW, data, and ICT (information communications technology)
- Provider Organization
  - Hospital, health system, physician practice, integrated delivery system, nursing home, rural health clinic
- Electronic Health Record (EHR)
- Personal Health Record (PHR)

20

20

Characteristics: Two primary information systems

- Administrative
  - Charge capture
  - Coding and documentation review
  - Managed care contracting
  - Denial management of claims
  - Payment posting
  - Accounts receivable follow-up
  - Patient Collections
  - Reporting and benchmarking
- Clinical
  - Departmental systems
  - Decision support
  - Medication administration
  - Provider order entry
  - EHR systems
  - Can be limited to a single area or comprehensive over all aspects of patient care

21

21

Features and Functions: Electronic Health Records

- Electronically collect and store patient data
- Supply information to providers
- Allow direct input into a computerized provider order entry (CPOE) system
- Advise health care practitioners
  - Best practice guidelines

22

22

Patient Portals

- Secure website
- Electronically access their records
- Schedule appointments
- Communicate with provider
- Request refill on prescriptions
- Review test results
- Pay bills

23

23

Personal Health Records

- Receive customized content based on needs, values, and preferences
- Lifelong, comprehensive, support information exchange and portability
- Reduce costs by avoiding unnecessary duplicate tests and improving communications
- Person-generated health data (PGHD)
  - Mobile technologies and applications to capture health and wellness
  - Step trackers, web-based food diaries, networked weight scales, blood pressure machines

24

24

EHR Adoption Rates

- https://dashboard.healthit.gov/quickstats/quickstats.php
- 84% of US nonfederal acute care hospitals had adopted basic EHR systems by 2015
- Adoption rates for specialty hospitals is lower because they were not eligible for HITECH incentive programs
- 79% of primary care physicians and 70% of surgical specialties had adopted a certified EHR system by 2014
- 44% of home health and hospice agencies have adopted EHR systems

25

25

Benefits: EHR systems

- Quality, outcomes, and safety
  - Adherence to evidence-based care
  - Enhanced surveillance and monitoring
  - Decreased medication errors
- Efficiency, improved revenues, and cost reduction
- Provider and patient satisfaction

26

26

Devil is in the details: Implementation matters

- Same EHR/clinical information system can be implemented in different organizations and have different results
  - One hospital experienced a significant increase in mortality (Han et al., 2005)
    - Issues with several implementation issues (e.g., several critical specific order sets not implemented, workflow changes)
  - The other did not (DelBeccaro et al., 2006)
- Implementation Science

27

27

Key Issues & Challenges 1: HCIS - Interoperability

- The ability of a system to exchange health information from other systems without special effort on the part of the user
- Information blocking
  - When persons or entities knowingly and unreasonably interfere with exchange or use of electronic health information
- ONC Roadmap to Interoperability
  - Requiring standards
  - Motivating the use of standards through appropriate incentives
  - Creating a trusted environment for collecting, sharing, and using electronic health information

28

28

Key Issues & Challenges 2: HCIS - Usability

- The effectiveness, efficiency, and satisfaction with which the intended users can achieve their tasks in the intended context of product use
- UX: User Experience
  - https://tidepool.org/

29

29

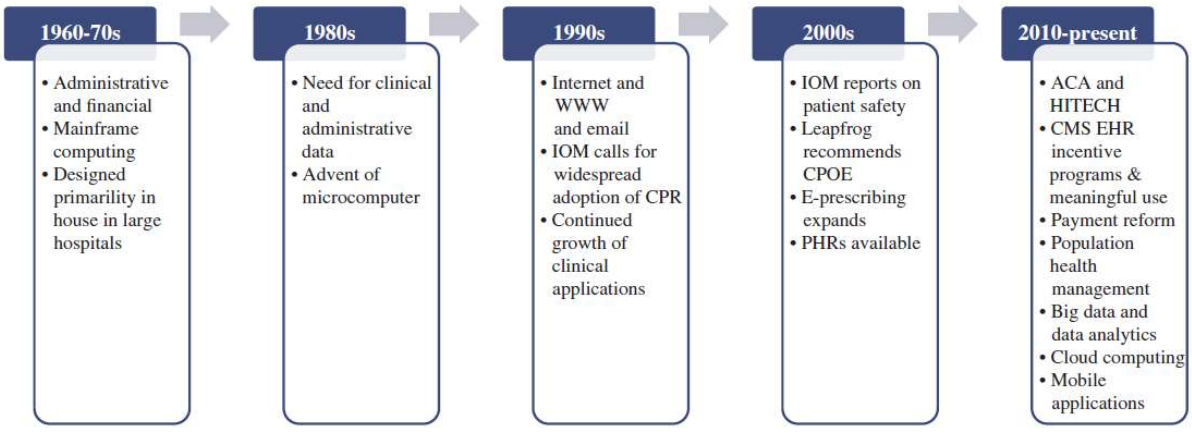
Key Issues & Challenges 3: HCIS - Health IT Safety

- Includes
  - adverse events that reached the patient
  - near misses that did not reach the patient
  - or unsafe conditions that increase the likelihood of a safety event
- Measuring, monitoring, and creating an environment that is conducive to detecting, fixing, and learning from system vulnerabilities
- BUGS in IS/IT is inevitable
  - Consequences

30

30

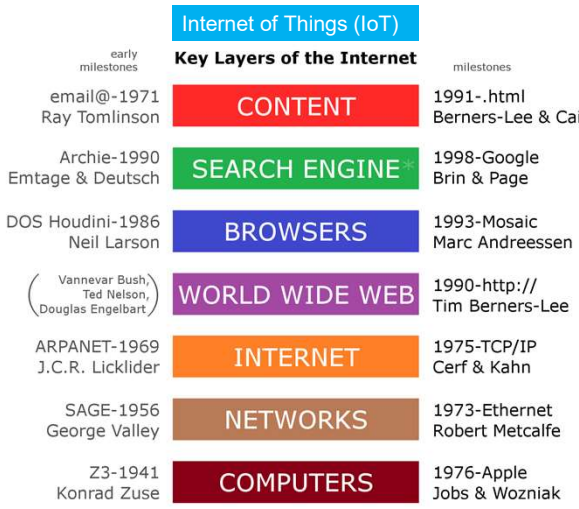
History and Evolution



31

31

http://en.wikipedia.org/wiki/File:Internet_Key_Layers.png



- IoT: wireless devices
- Content: semantic web
- Search Engine: easy to "index"/find documents on WWW
- Browser: graphical browser, possible for non experts to use WWW
- WWW: a network of documents on the Internet. It uses Internet (physical network) to have a LARGE number of computers talking to each other using HTTP protocol to manage the collection of documents
- Internet: TCP/IP – packet based WAN using TCP/IP
- Network: group of computers interoperating
- computers: how does it work

32

Summary: Evolution of The Web

Acknowledgement: Thomas Malone, Chris Dellarocas

Now?

Presence	Transactions	Business
Publish Information	**Process Transactions**	**Digital Economy**
Collection of Static Documents	Collection of Dynamic Pages (DP)	Social Media, IoT Semantic Web
Websites	Wed-enabled Existing Systems	Business Transformation
Pages	Transactions	Business Processes
Islands	Islands	Constellations
Eyeballs	Revenue	Profits

- Web 1.0
  - Linked documents
  - People Read things
- Web 2.0
  - Applications (software)
  - People do things
  - Wikipedia (crowd), social media (facebook), social tagging
- Web 3.0
  - semantic web
  - Computers do things

33

IoT (Internet of Things)

- The inclusion of electronics and software in any device not usually considered computerized in nature
- To enable it to achieve greater value and service
  - by giving it an ability to network and communicate with other devices.
  - each item is uniquely identifiable through its embedded computing device
  - but is able to interoperate within the existing Internet infrastructure
- Example: home health

34

Takeaway I
Computers …

- Every few years,
  - computers will be able to support (or automate) more of the activities that go on in business.
  - 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
- Computer Systems can be
  - FAST, CHEAP, or RELIABLE
  - Choose any two

35

Takeaway II
Summary

POPULATION INFORMATICS

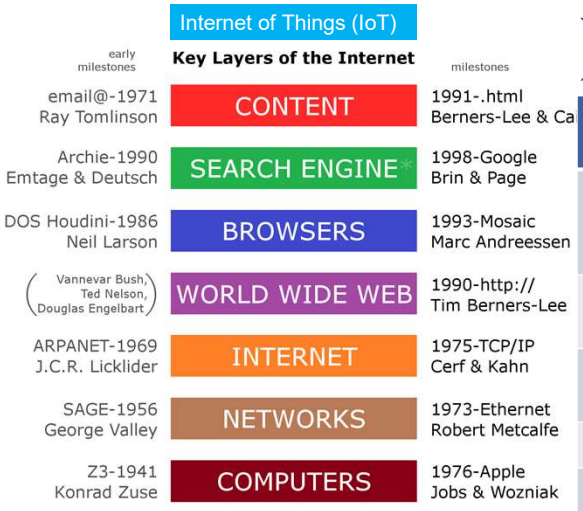
- Two main health care information systems
  - Administrative
  - Clinical
- Brief history of health care information systems
- Electronic health records (EHR)
- Personal (PHR) health records
- Patient Portals
- EHR adoption rates
  - Higher for those eligible for HITECH incentives
- Value of EHR systems
  - Safety
  - Revenue
  - Satisfaction
- Key issues related to EHR systems
  - Interoperability
  - Usability
  - Health IT Safety

36

36

Takeaway III
Key layers and evolution of web technology

POPULATION INFORMATICS



Presence	Transactions	Business
Publish Information	**Process Transactions**	**Digital Economy**
Collection of Static Documents	Collection of Dynamic Pages (DP)	Social Media, IoT Semantic Web
Websites	Wed-enabled Existing Systems	Business Transformation
Pages	Transactions	Business Processes
Islands	Islands	Constellations
Eyeballs	Revenue	Profits

37

Read Assignment 3 during break

38

Assignment 3

- At least 2 research articles
- Total of at least 5 sources including the 2 research articles
  - Add this in the appendix (first 15 pages. Add link to full source.)
- May be group project up to 3 people
- I will use turn it in

39

39

Next week

- Read Chapter 4
- Quiz 3
- Lab 3
- Start on Assignment 3 (2 weeks)