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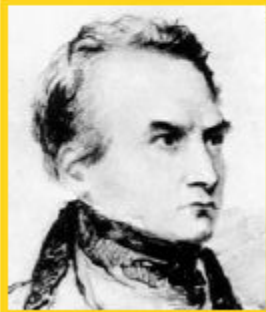
Computing Disciplines & Computer Science

Pengantar Teknik Informatika (HUG1M2)

2013-1
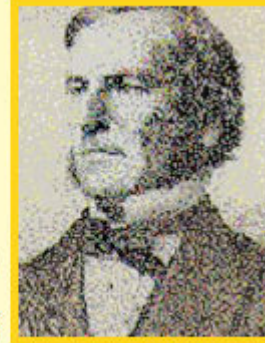
Jika mereka tidak ada …

**1822** Charles Babbage begins to design and build the Difference Engine.

1842-43 Augusta Ada, Countess of Lovelace, translates Luigi Menabrea's pamphlet on the Analytical Engine, adding her own commentary.

1934 In Germany, Konrad Zuse seeks to build a better calculating machine than those currently available.

1854 George Boole publishes "An Investigation of the Laws of Thought," describing a system for symbolic and logical reasoning that will become the basis for computer design.
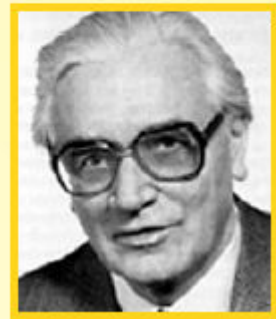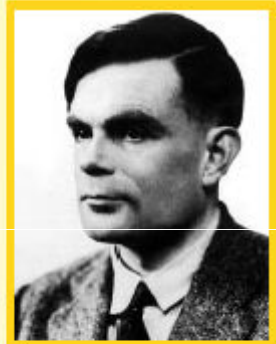
1930 The Differential Analyzer, devised by Vannevar Bush and colleagues at MIT, solves various differential equations.

1946 Alan Turing publishes a report on his design for ACE (Automatic Computing Engine), featuring random extraction of information.

1948 Claude Shannon publishes "A Mathematical Theory of Communication," formulating the modern understanding of the communication process.

1947 On December 23, Bell Labs management is informed by John Bardeen and Walter Brattain that along with William Shockley they have developed the first transistor.

Source: IEEE-Computer Society, Timeline of Computing History

1952 John von Neumann's IAS bit-parallel machine is completed in June for the Institute of Advanced Studies at Princeton, New Jersey.
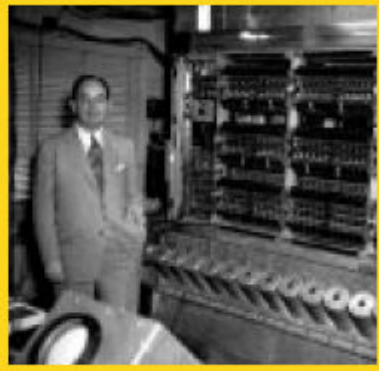
Institute for Advanced Study

1960 Working at Rand Corp., Paul Baran develops the packet-switching principle for data communications.

Rand Corp.

1964 Doug Engelbart invents the mouse.

Bootstrap Institute

1962 The first video game is invented by MIT graduate student Steve Russell. It is soon played in computer labs all over the US.

The Computer Museum

1971 Ray Tomlinson of Bolt Beranek and Newman sends the first network e-mail message.

Bolt Beranek and Newman

1977 Steve Jobs and Steve Wozniak incorporate Apple Computer on January 3.

Apple Computer, Inc.

1968 Robert Noyce, Andy Grove, and Gordon Moore establish Intel, which is incorporated on July 18.

Intel Corporation

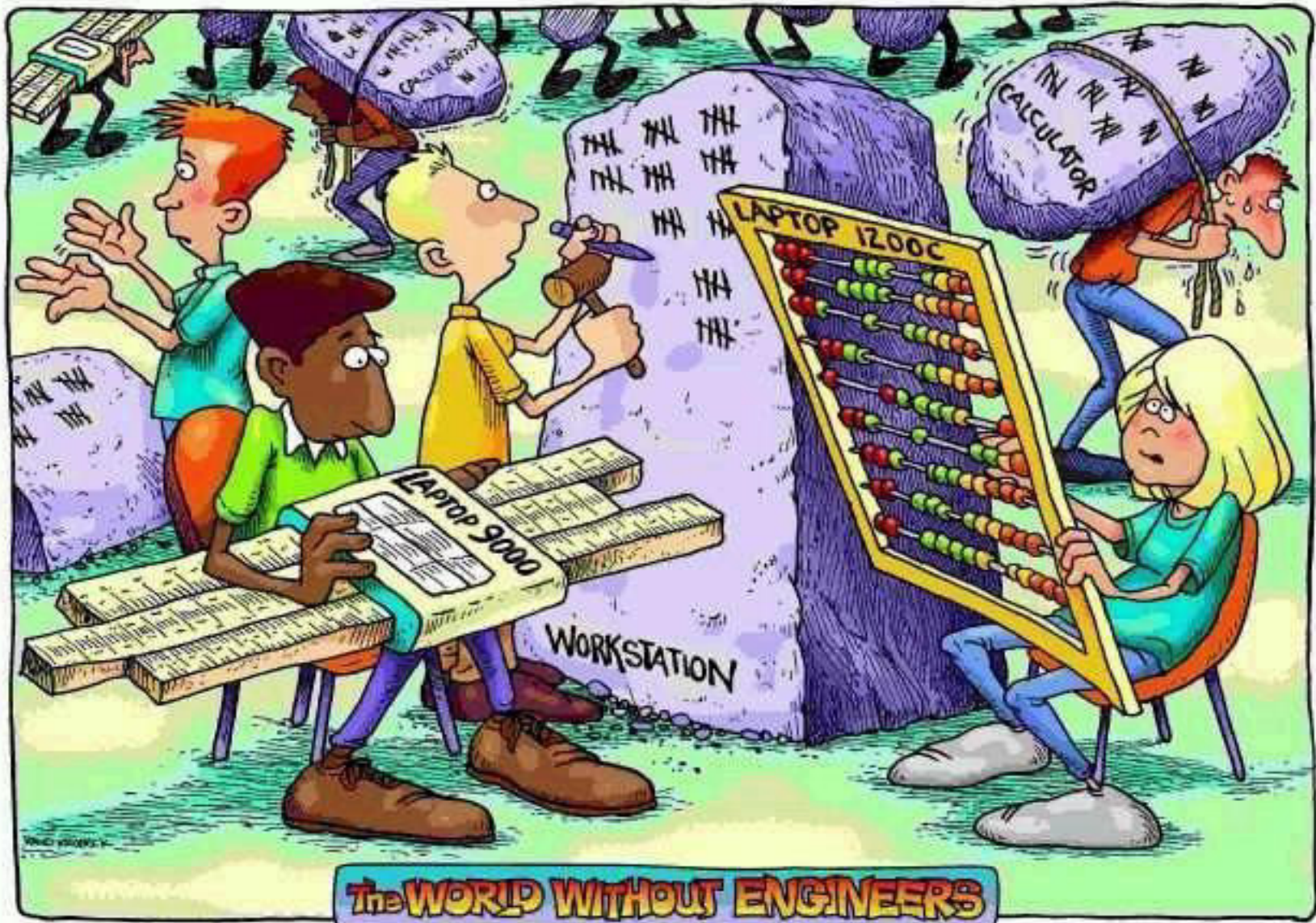**1970** Unix is developed at Bell Labs by Dennis Ritchie and Kenneth Thomson.

Bell Laboratories

Bell Laboratories

**1977** Bill Gates and Paul Allen found Microsoft, setting up shop first in Albuquerque, New Mexico.

Microsoft Archives

The WORLD WITHOUT ENGINEERS

Agilent Technologies

http://www.educatorscorner.com

1989 Tim Berners-Lee proposes the World Wide Web project to CERN (European Council for Nuclear Research).
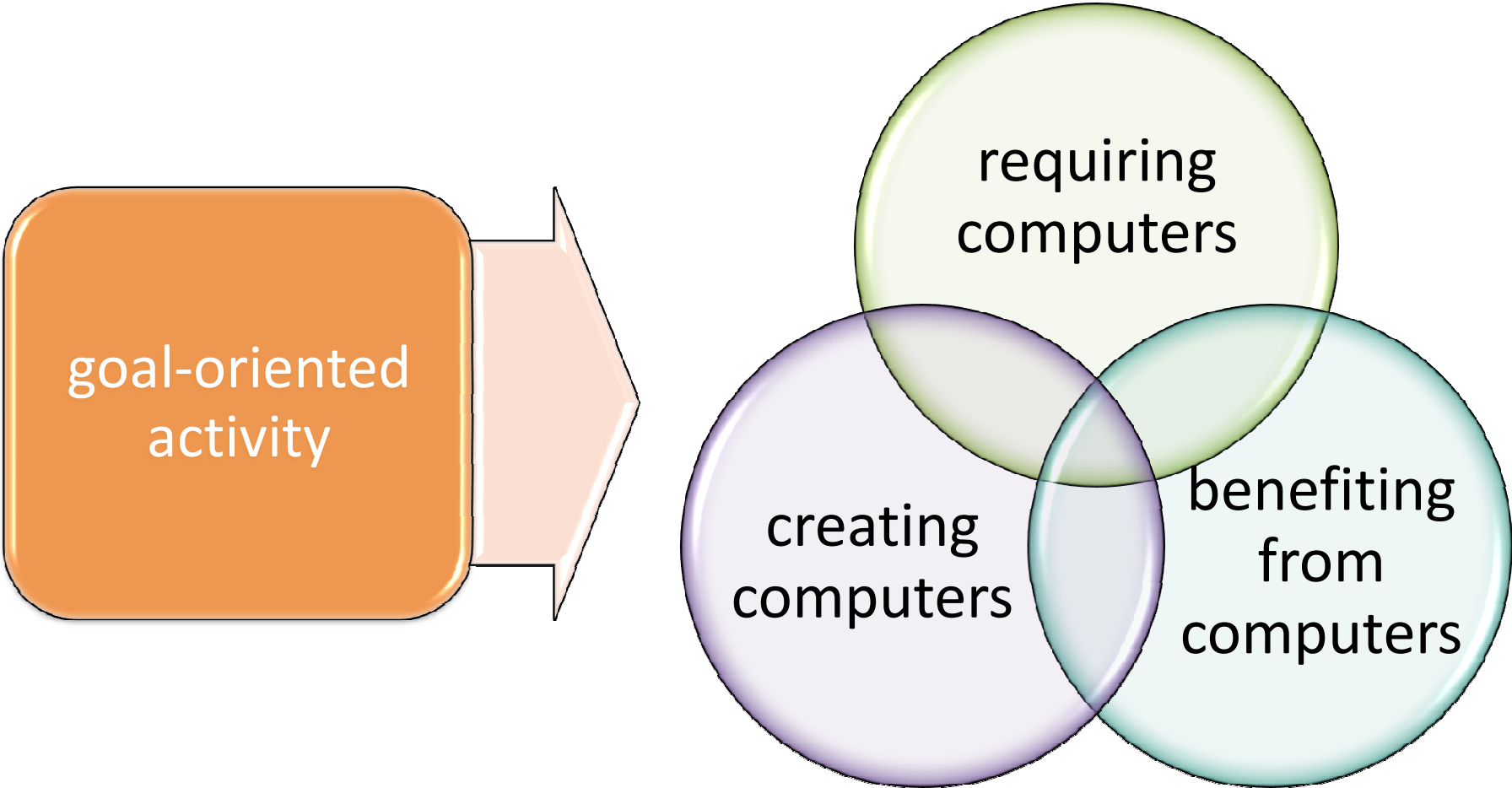
Tim Berners-Lee:

- *"I think a lot of folks growing up today, when they open a computer, it's like opening a refrigerator. It's an appliance, it's white goods, there's some stuff in it, if it needs more in it you stock it, you put more music in it, you play it. And If it breaks it's: 'Mom, can I have a new one'."*
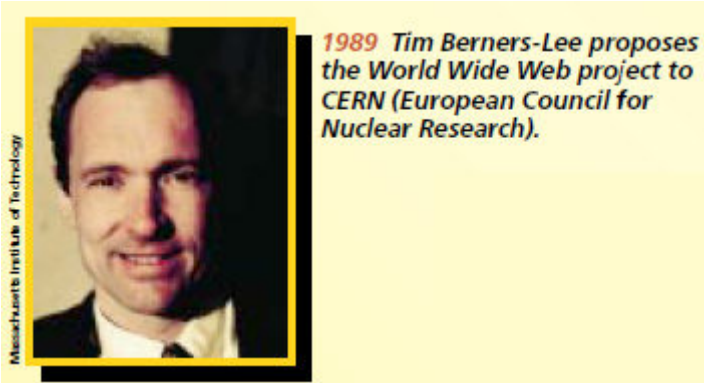
(still) Tim Berners-Lee:

- *"It's very important in education with this computer science, which is understanding the philosophy of computer and the mathematics of computing, and learning to really build stuff, it's very different from the IT class, and I think making that distinction very clear and maybe early on in schools is very important."*

[http://www.vg247.com/2013/01/28/berners-lee-calls-for-computer-science-education-at-a-younger-age/]

Computing

goal-oriented activity

requiring computers

creating computers

benefiting from computers

Computing includes…

- Designing and building hardware and software;
- Processing, structuring, and managing various kinds of information;
- Doing scientific studies using computers;
- Making computer systems behave intelligently;
- Creating and using communications and entertainment media;
- Finding and gathering information relevant to any particular purpose,
- and so on.

Computing as a discipline

- Computing also has other meanings that are more specific, based on the context in which the term is used.
    - an information systems specialist will view computing somewhat differently from a software engineer
- Because society needs people to do computing well, we must think of computing not only as a profession but also as a discipline

The Landscape of Computing Disciplines
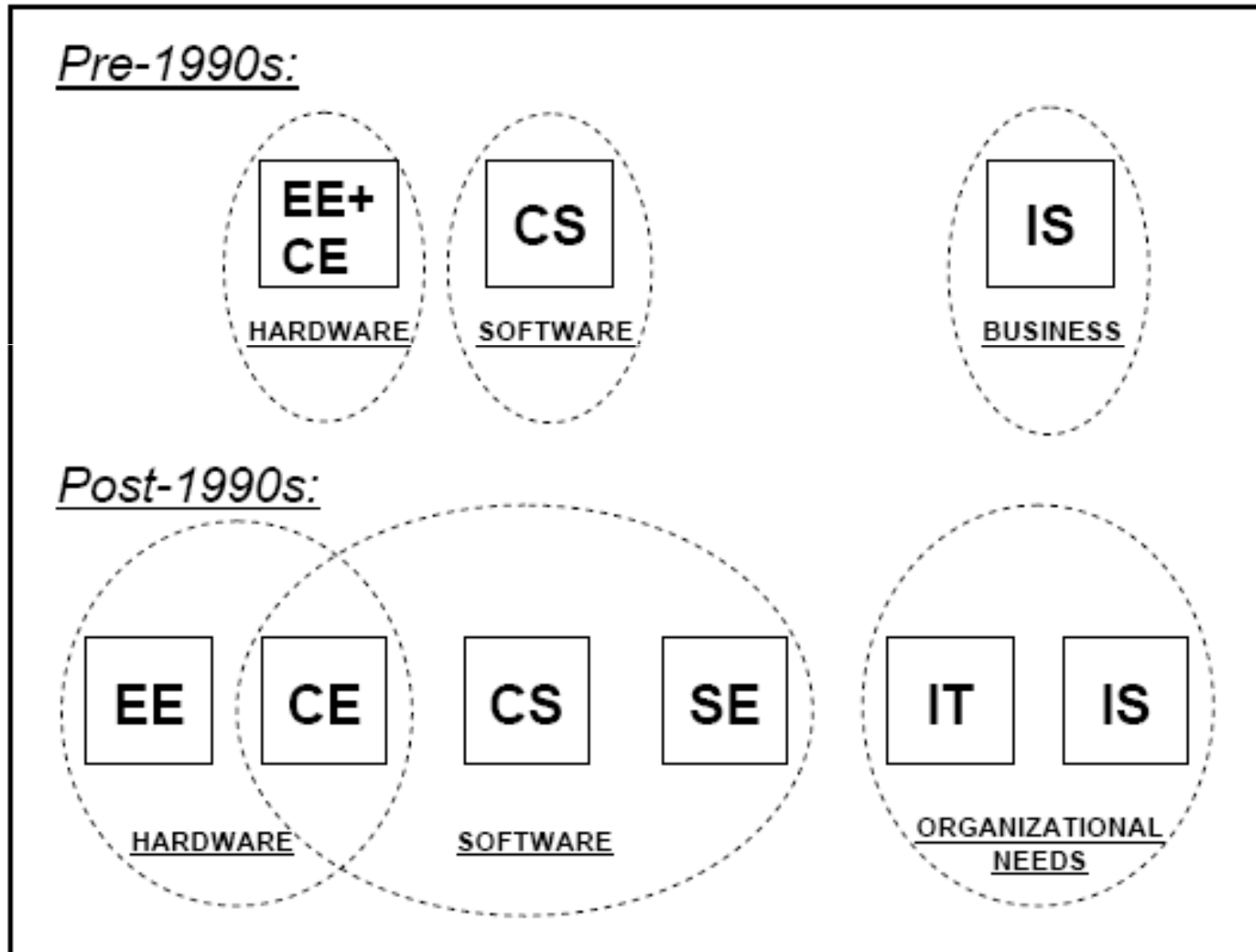
Science & Engineering
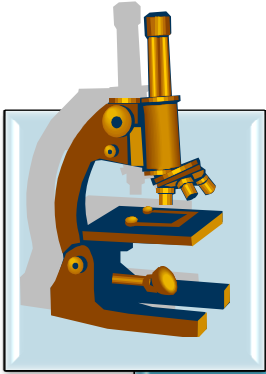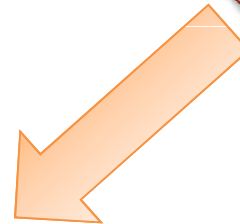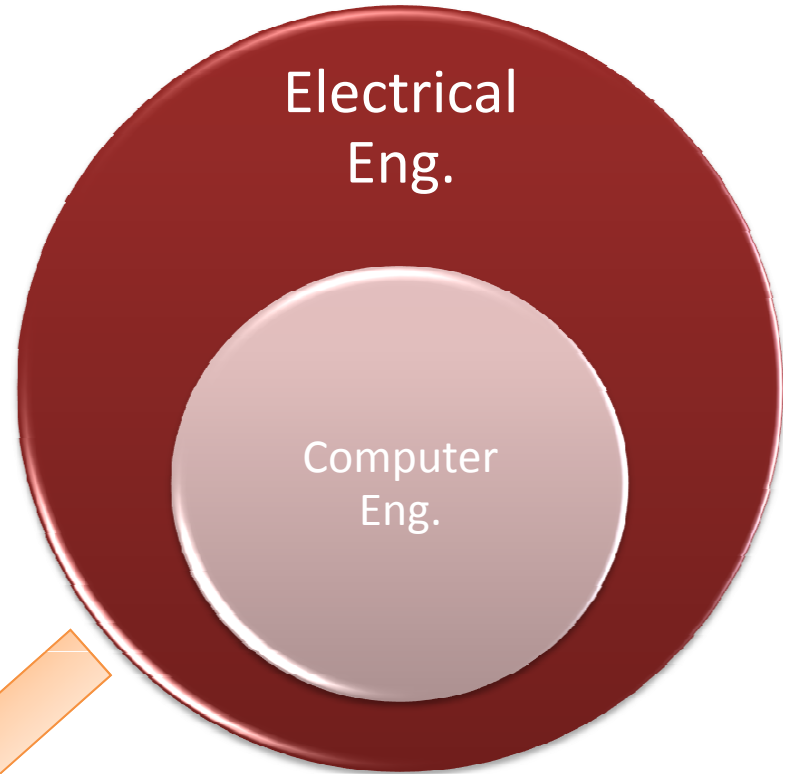
Sciences

- focuses on creating new knowledge

Engineering

- focuses on rigorous methods for designing and building things that reliably do what they're supposed to do
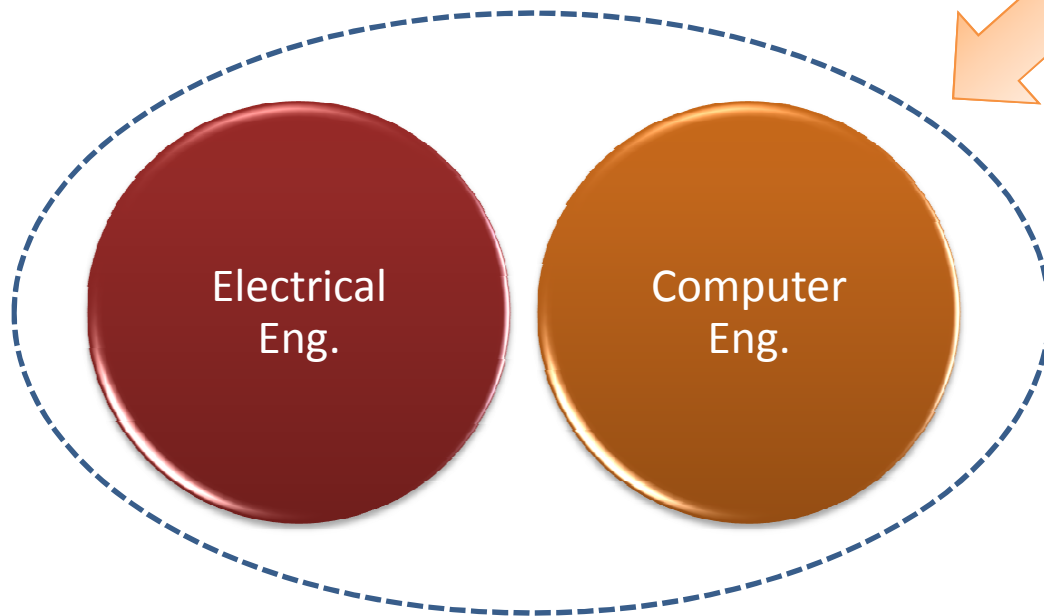
The emergence of CE

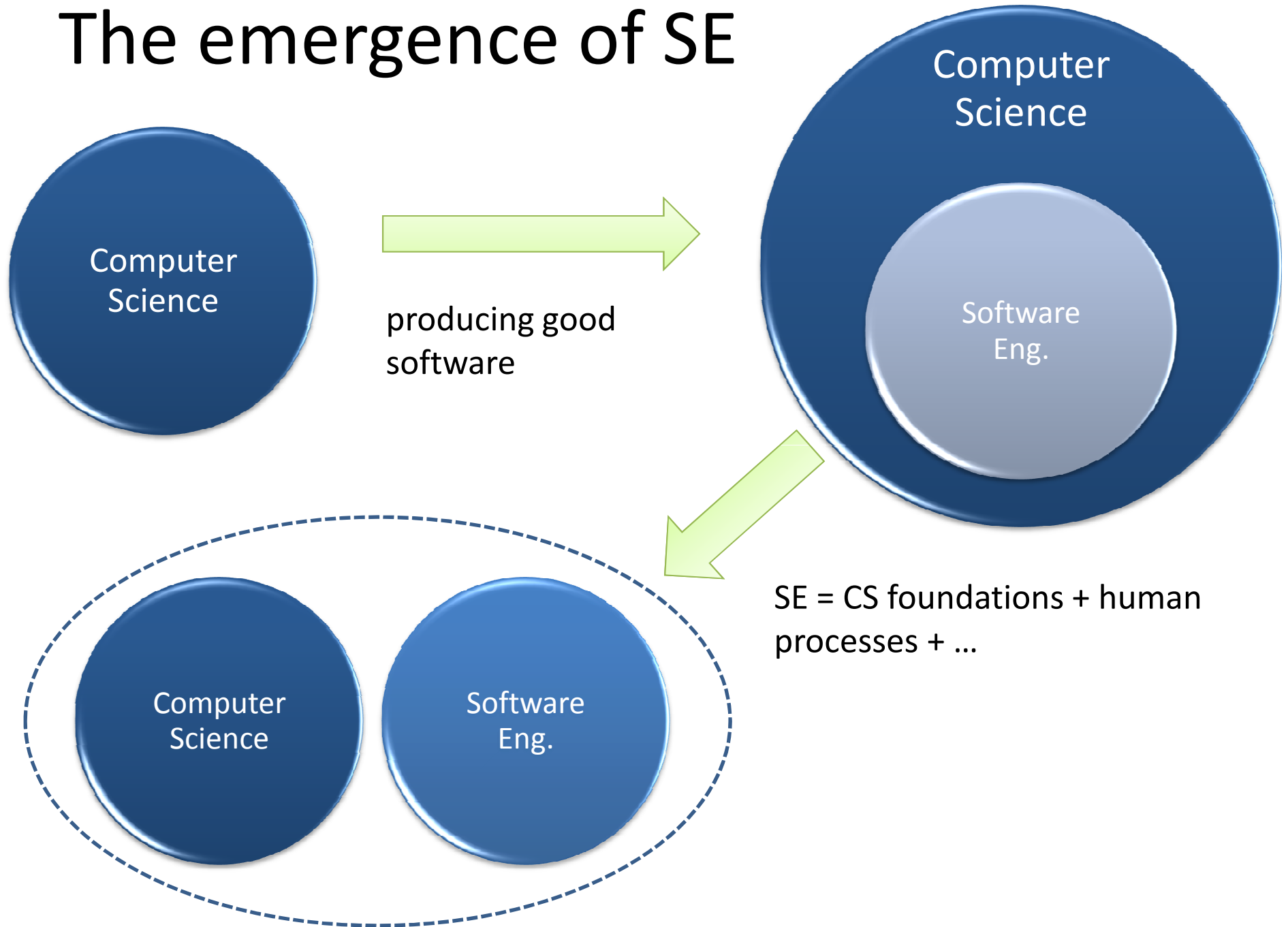Electrical Eng.

→ the invention of chip-based microprocessors

Electrical Eng.

Computer Eng.

Electrical Eng.

Computer Eng.

computer chips became basic components of most kinds of electrical devices and many kinds of mechanical devices

The emergence of SE

Computer Science

producing good software

Computer Science

Software Eng.

SE = CS foundations + human processes + …

Computer Science

Software Eng.
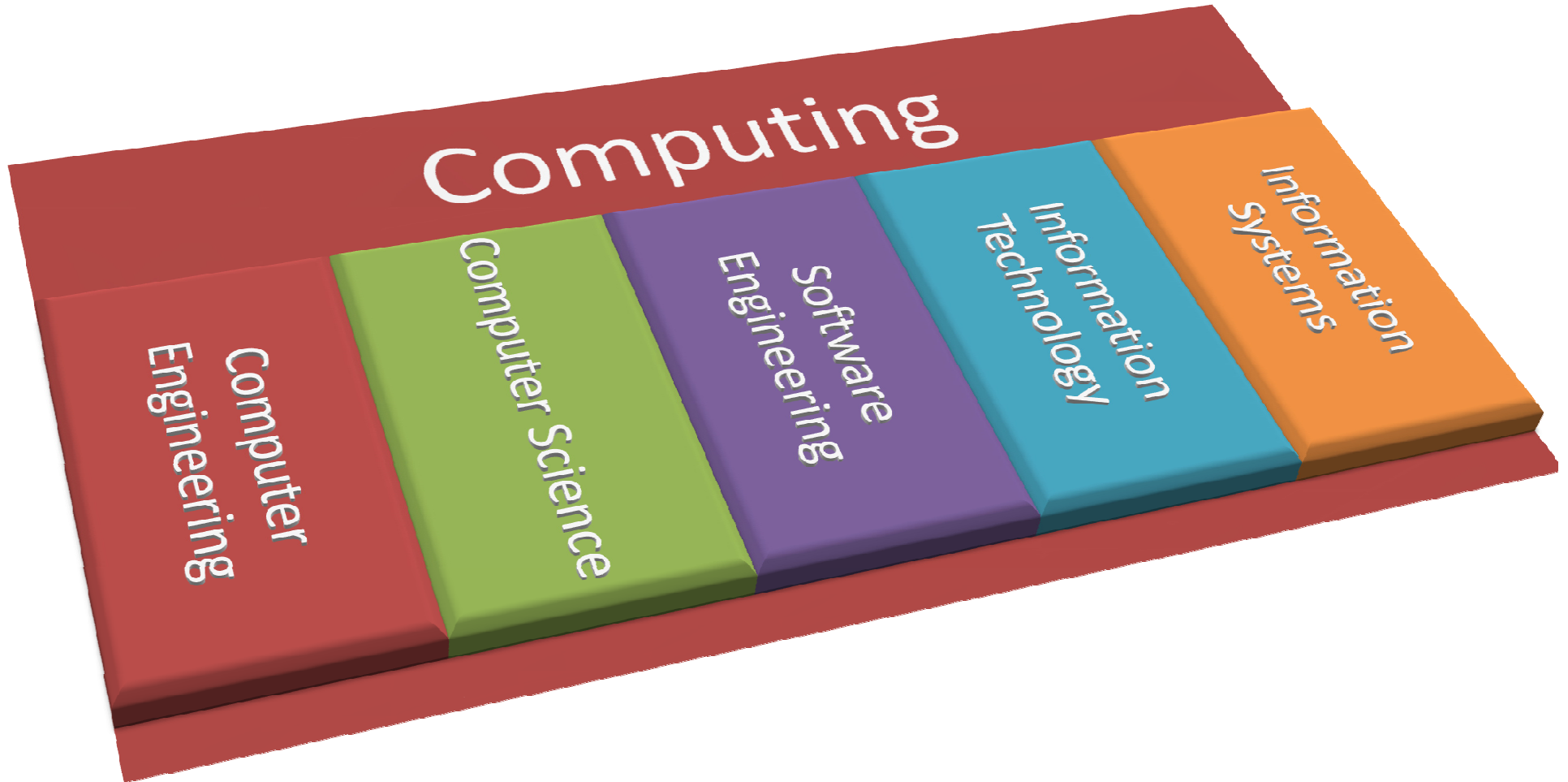
The birth of IT

- Computers → essential work tools
- Networked computer systems → information backbone of organizations

- The right mix of knowledge and skills to ensure:
  - the organization's computing infrastructure: suitable & worked reliably
  - people in the organization had their computing-related needs met, problems solved, etc.

Let's describe each of them...

Computer Engineering

- concerned with the **design** and **construction** of **computers and computer-based systems**.
  - hardware, software, communications, and the interaction among them
- Currently, a dominant area within computing engineering is **embedded systems**
  - devices that have SW and HW embedded in them

Computer Science

- spans a wide range
  - from its **theoretical and algorithmic foundations** to **cutting-edge developments** in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas

- a comprehensive foundation that permits graduates to adapt to new technologies and new ideas

The work of computer scientists

- Design and implement software
  - programming & supervise other programmers
- Devise new ways to use computers
  - WWW, data mining, intelligent devices, deciphering DNA etc.
- Develop effective ways to solve computing problems
  - theoretical background → to determine the best performance possible
  - study of algorithms → to develop new approaches that provide better performance

Software Engineering

- the discipline of developing and maintaining software systems that:
  - behave reliably and efficiently,
  - affordable to develop and maintain
  - satisfy all the requirements

- SE has evolved
  - the growing impact of large and expensive software systems in a wide range of situations
  - the increased importance of software in safety-critical applications

Information System
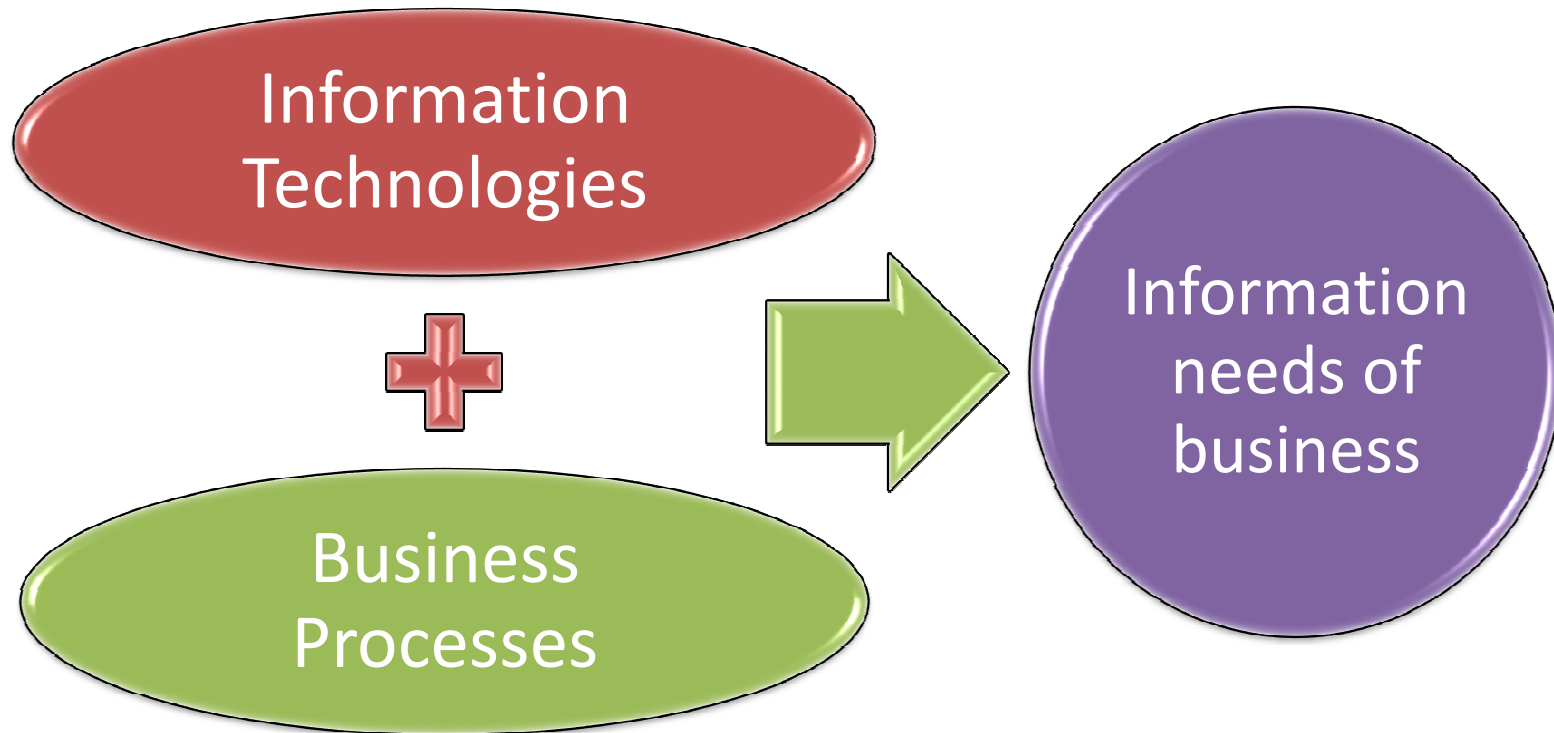
IS (cont'd)

- focuses on the information aspects of information technology
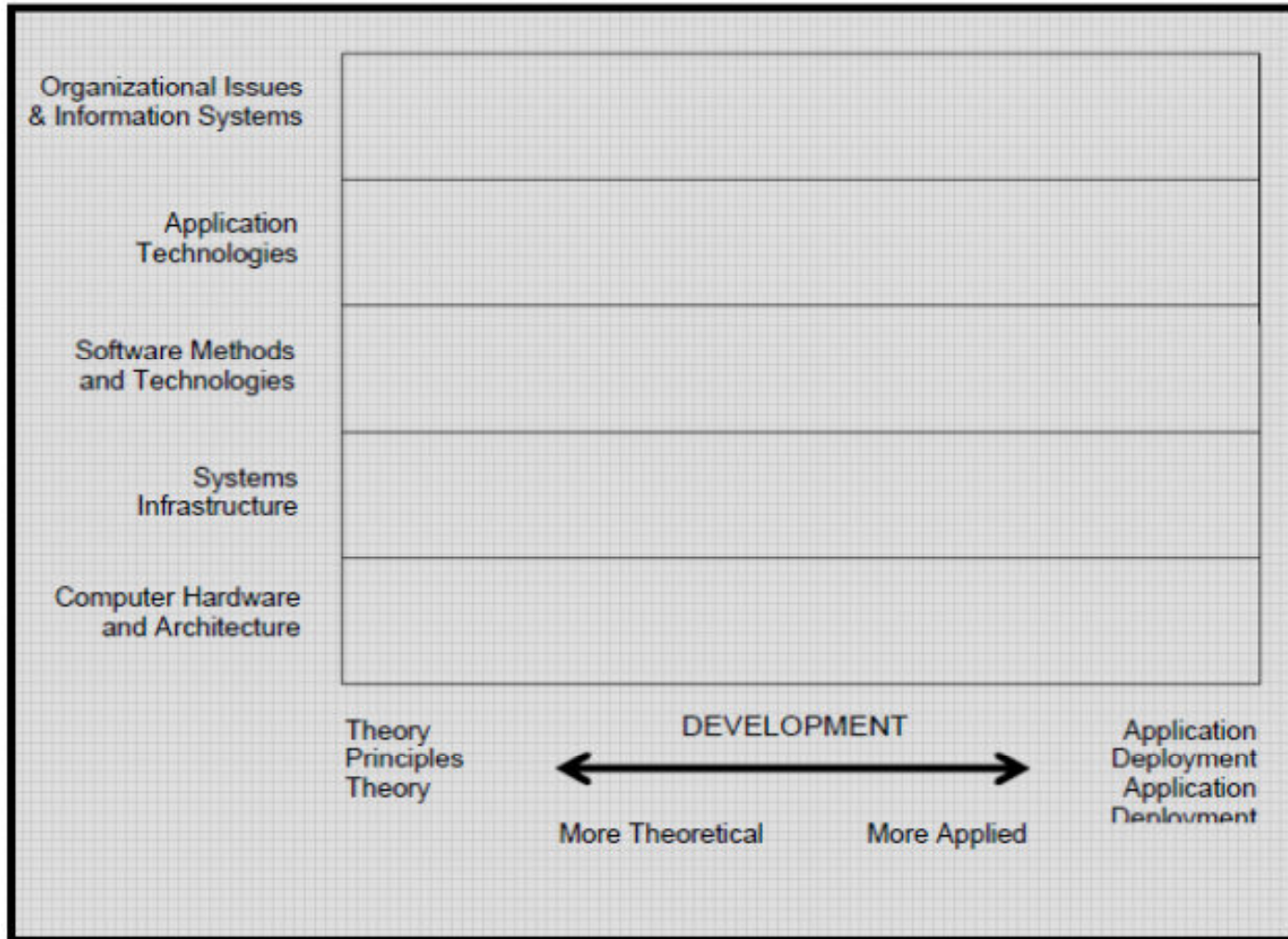- views technology as an instrument for generating, processing, and distributing information

Information Technology

- In the broadest sense: often used to refer to all of computing

- In academia: undergraduate degree programs that prepare students to meet the computer technology needs of organizations
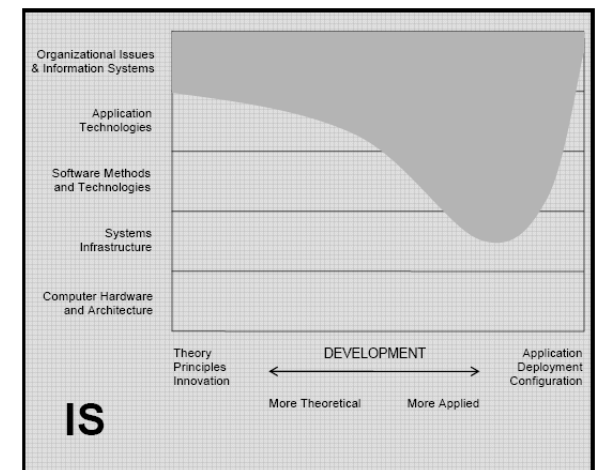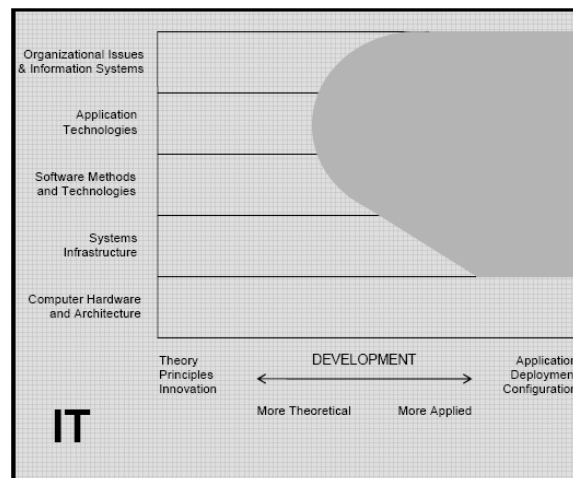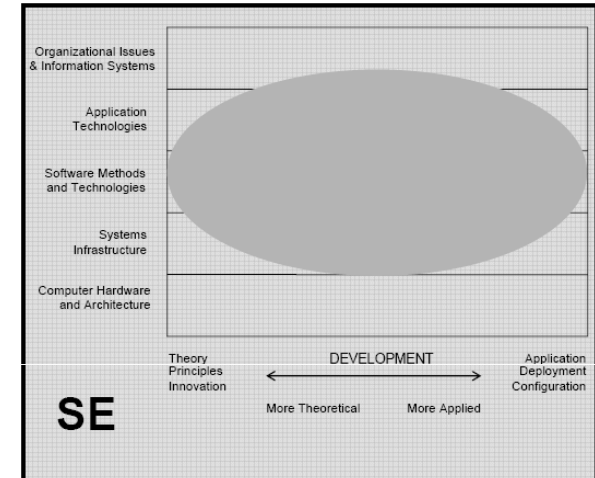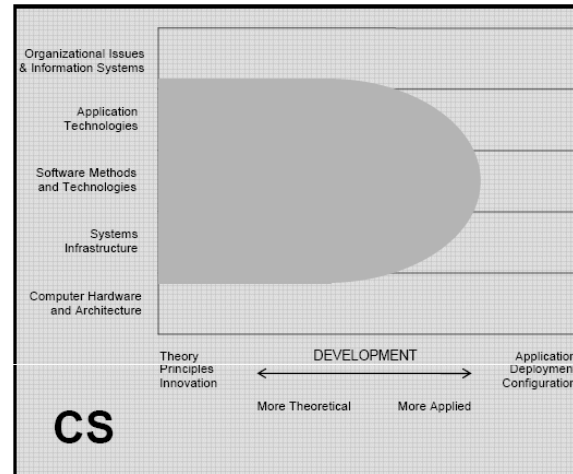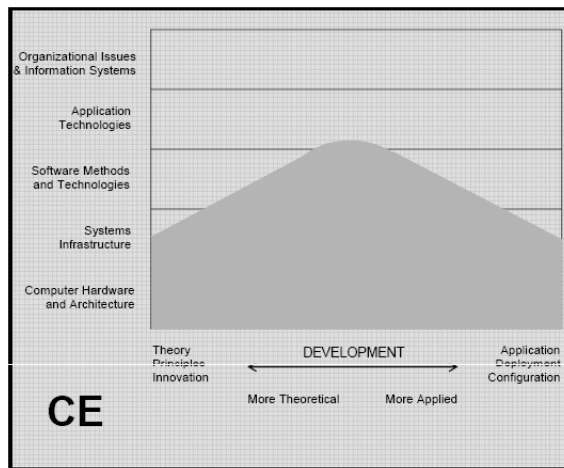
IT (cont'd)

- (Networked) Computer-based systems must work properly, be secure, and upgraded, maintained, and replaced as appropriate.

- Graduates: possess the right combination of knowledge and practical, hands-on expertise to take care of both an organization's information technology infrastructure and the people who use it

The *problem space* of computing

		DEVELOPMENT	
Organizational Issues & Information Systems			
Application Technologies			
Software Methods and Technologies			
Systems Infrastructure			
Computer Hardware and Architecture			

Theory
Principles
Theory

DEVELOPMENT
←——————————→

Application
Deployment
Application
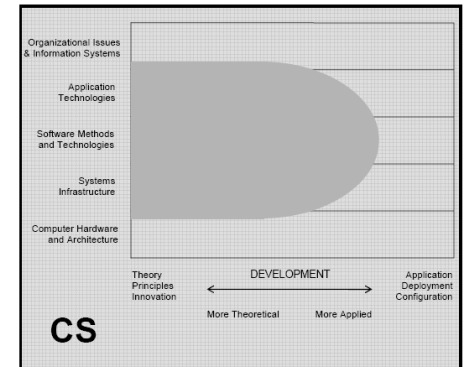Deployment

More Theoretical   More Applied

Graphical views:
typically do after graduation

Focus on CS

- computer scientists:
    - care about: down as far as the software that enables devices to work and up as far as the information systems that help organizations to operate
    - design and develop all types of software from systems infrastructure (operating systems, communications programs, etc.) to application technologies (web browsers, databases, search engines, etc.)
    - create these capabilities but they do not manage the deployment of them & do not select, tailor, or learn to use computing products

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