THE COMPUTING DISCIPLINE

June 6, 2011

Goal of the Talk

- **To provide perspective for those who need to understand**
  - what the major computing disciplines are, and
  - how they compare and complement each other.

The Computing Discipline

- Computing is a broad discipline that crosses the boundaries between mathematics, science, engineering, and business.

The Computing Discipline...

Computer Science

or

Computing Science ?

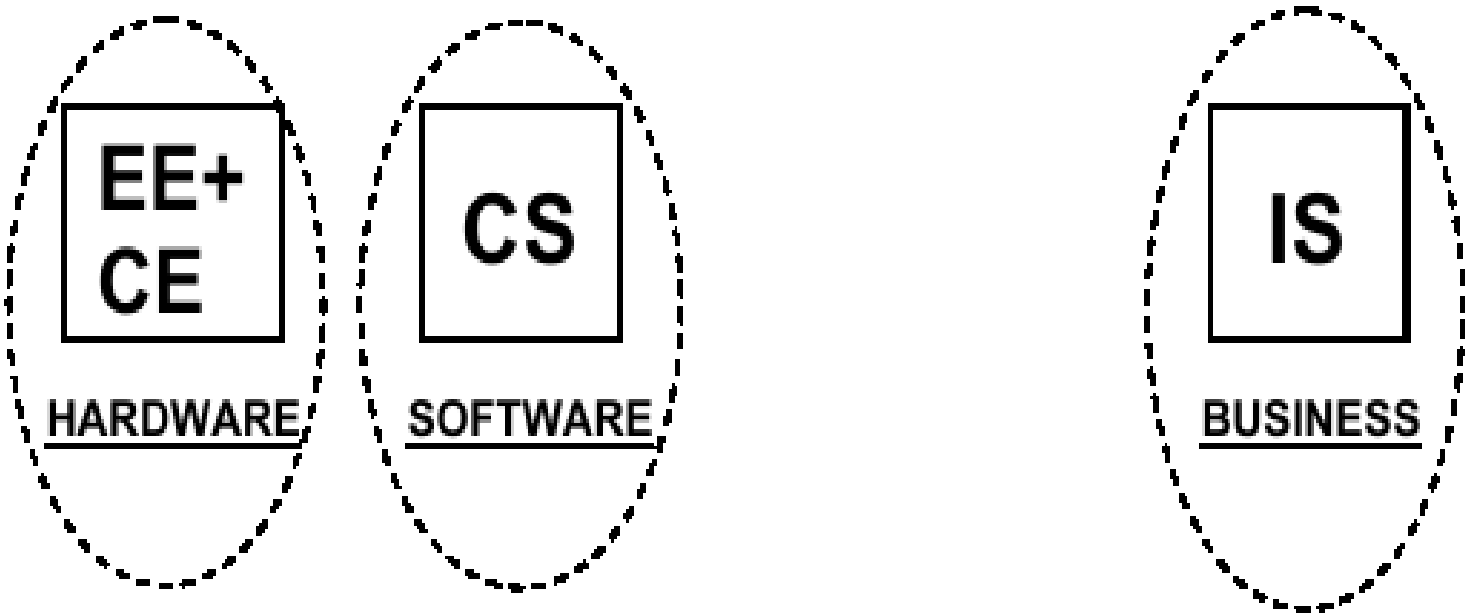
Computing Disciplines: Before the 1990s

- Before 1990s there were only three kinds of computing-related degree programs:
  - Computer Science,
  - Electrical Engineering, and
  - Information systems.

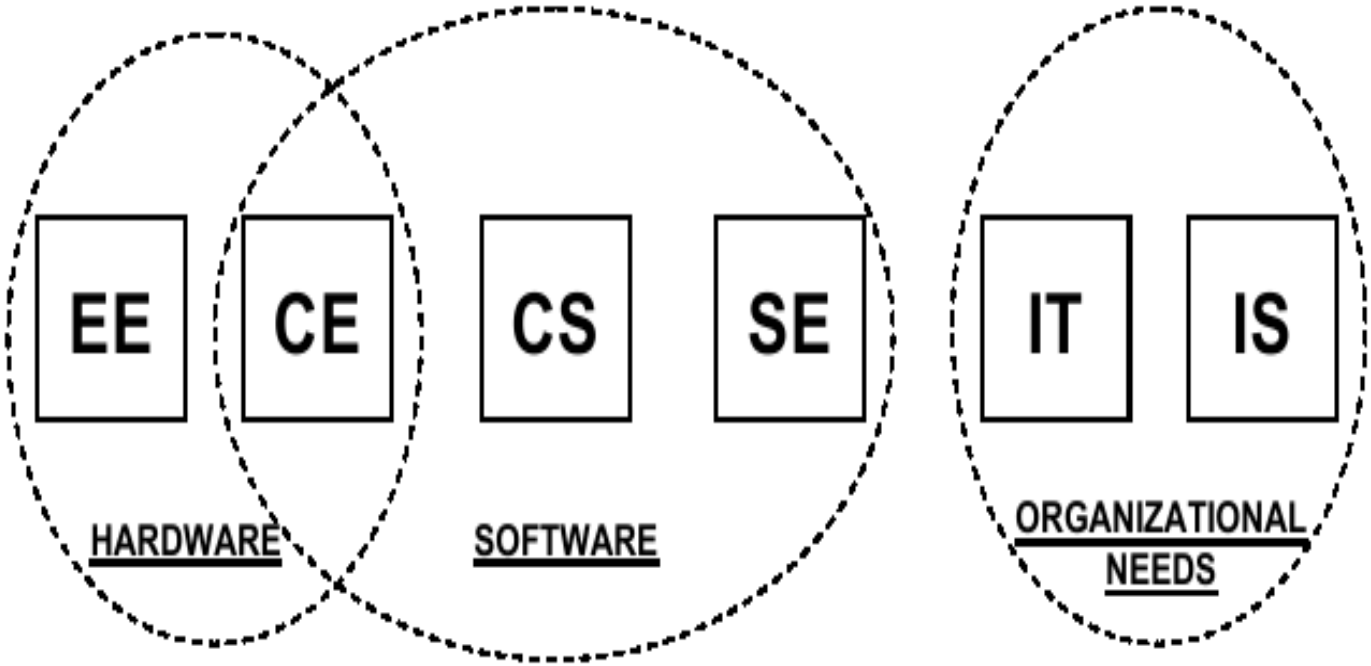
Computing Disciplines: Before the 1990s...

- For students who wanted to become expert in developing software or with the theoretical aspects of computing, **Computer Science** was the obvious choice.
- For students who wanted to work with hardware, **Electrical Engineering** was the clear option.
- For students who wanted to use hardware and software to solve business problems, **Information Systems** was the right choice.

Computing Disciplines : Pre-1990s



Computing Disciplines : Post-1990s



Computing Discipline: Body of knowledge

- Discrete Structures
- Programming Fundamentals
- Algorithms and Complexity
- Architecture and Organization
- Operating Systems
- Net-Centric Computing

Computing Discipline: Body of knowledge

- Programming Languages
- Software Engineering
- Intelligent Systems
- Information Management
- Graphics and Visual Computing
- Human-Computer Interaction

Computing Discipline: Body of knowledge

- **Discrete Structures**
  - Functions, relations, and sets
  - Logic
  - Proof Techniques
  - Combinatorics
  - Graphs and Trees
  - Discrete probability

Computing Discipline: Body of knowledge

- **Programming Fundamentals**
  - Fundamental programming constructs
  - Algorithms and problem solving
  - Data structures
  - Recursion

Computing Discipline: Body of knowledge

- **Algorithms and Complexity**
  - Algorithmic analysis
  - Algorithmic strategies
  - Computability and complexity classes

Computing Discipline: Body of knowledge

- **Architecture and Organization**
  - Digital logic and digital systems
  - Machine organization and architecture

Computing Discipline: Body of knowledge

- **Operating Systems**
  - Process management
  - Memory management
  - Device management
  - File systems
  - Concurrency

Computing Discipline: Body of knowledge

- **Net-Centric Computing**
  - Communication and networking
  - Network management
  - Network security
  - Compression and decompression
  - Wireless and mobile computing

Computing Discipline: Body of knowledge

- **Programming Languages**
  - Abstraction mechanisms
  - Programming language design
  - Language translation systems

Computing Discipline: Body of knowledge

- **Software Engineering**
  - Problem Specification
  - Software design
  - Software development
  - Software reliability
  - Software project management
  - Software tools and environment

Computing Discipline: Body of knowledge

- **Intelligent Systems**
  - Knowledge representation and reasoning
  - Natural language processing
  - Robotics

Computing Discipline: Body of knowledge

- **Information Management**
  - Information models and systems
  - Database systems
  - Data modeling
  - Data mining
  - Information storage and retrieval

Computing Discipline: Body of knowledge

- **Graphics and Visual Computing**
  - Graphic systems
  - Geometric modeling
  - Rendering
  - Computer animation
  - Multimedia systems development

Computing Discipline: Body of knowledge

- **Human-Computer Interaction**
  - Graphical user-interface design
  - Graphical user-interface programming

Need for Classification

- Because Computing discipline provides a wide range of knowledge areas it is impossible for anyone to become proficient in all of them.
- Hence, an individual who wishes to become a computing-related professional requires some focus for his or her professional life.

Major Computing Disciplines

- Computer Engineering
- Computer Science
- Information technology
- Information Systems
- Software Engineering

Computer Engineering

- **Computer Engineering** is concerned with the design and construction of computers and computer-based systems.
- It involves the study of hardware, software, communication, and the interactions among them.

Computer Science

- **Computer Science** spans a wide range, from its theoretical and algorithmic foundations to cutting-edge development in robotics, computer vision, intelligent systems, bio-informatics, and other areas.

- We can think of the work of computer scientists as falling into three categories:
  - They develop effective ways to solve computing problems.
  - They device new ways to use computers.
  - They design and implement software.

Information Systems

- **Information Systems** specialists focus on integrating information technology solutions and business processes to meet the information needs of business and their enterprises, enabling them to achieve their objectives in an effective, efficient way.
- The Information Systems specialist plays a key role in determining the requirements for an organization's systems and is active in their specification, design, and implementation.

Information Technology

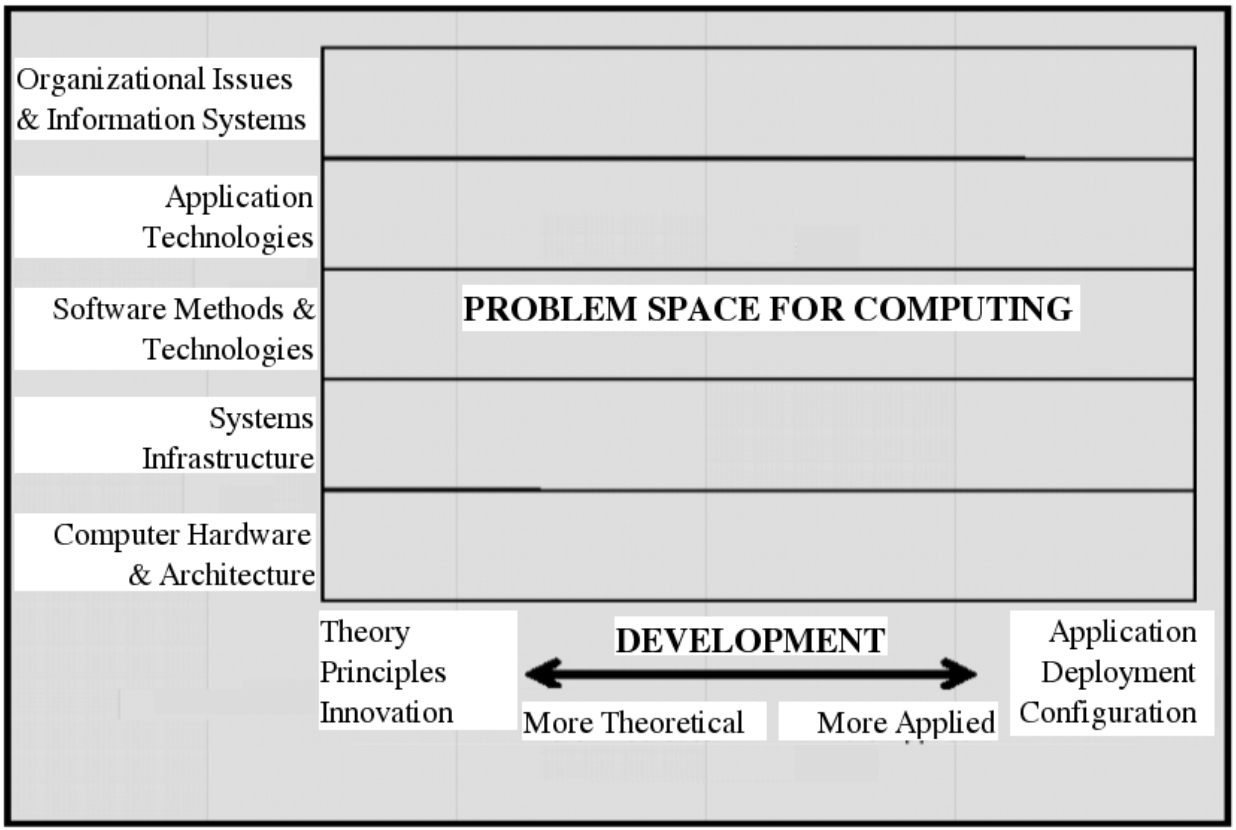
- **Information Systems** focuses on the information aspects of information technology. **Information Technology** is the counterpart of that perspective: its emphasis is on the technology itself more than on the information it conveys.

- IT specialists assume responsibility for selecting hardware and software products appropriate for an organization, integrating those products with organizational needs and infrastructure, and installing, customizing, and maintaining those applications for the organization's computer users.

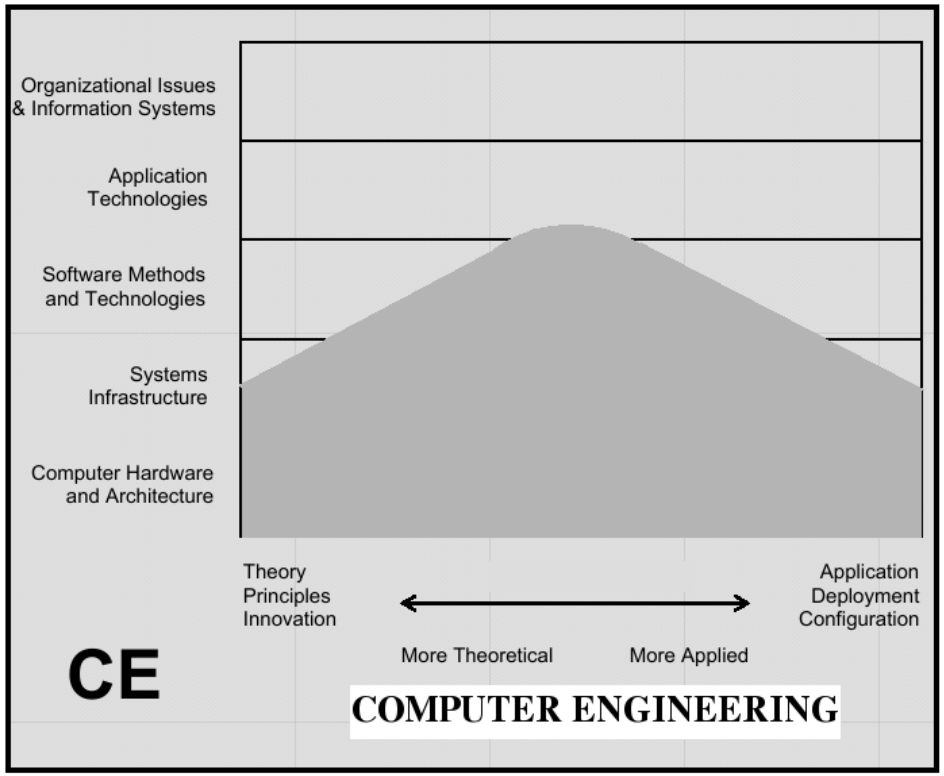
Software Engineering

- **Software Engineering** is the discipline of developing and maintaining software systems that behave reliably and efficiently, are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them.

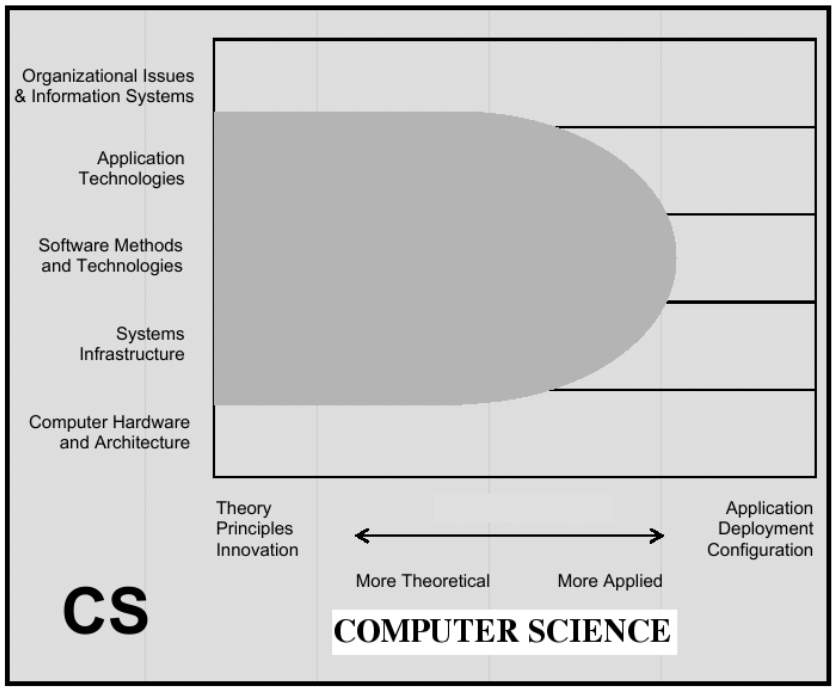
Graphical View of Computing Disciplines



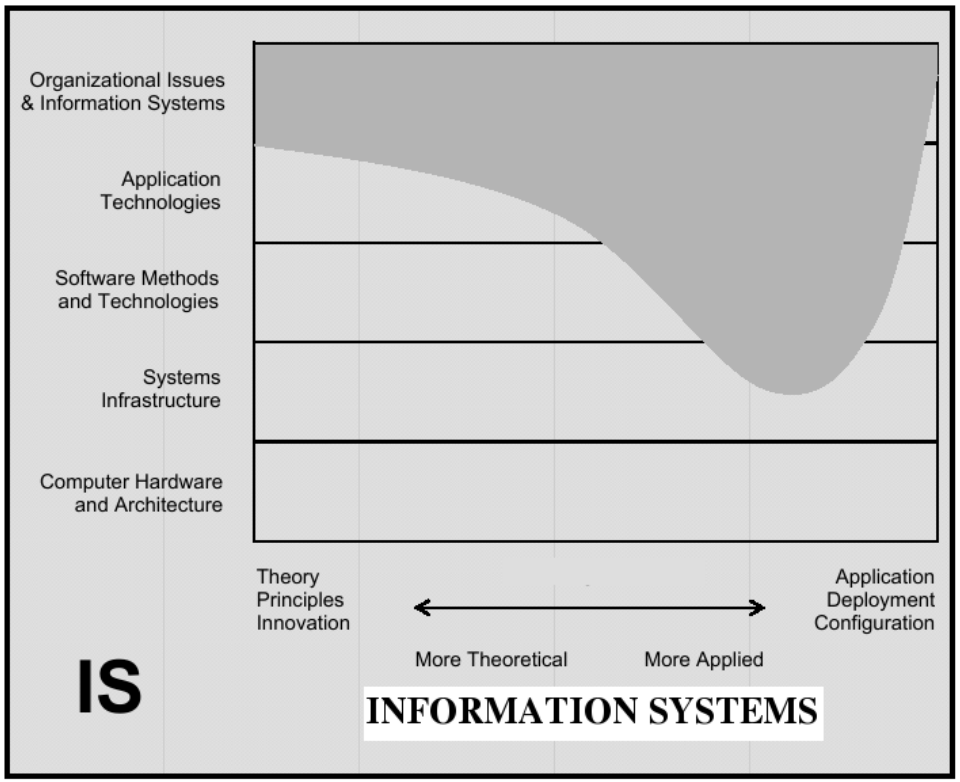
- Computer Engineering



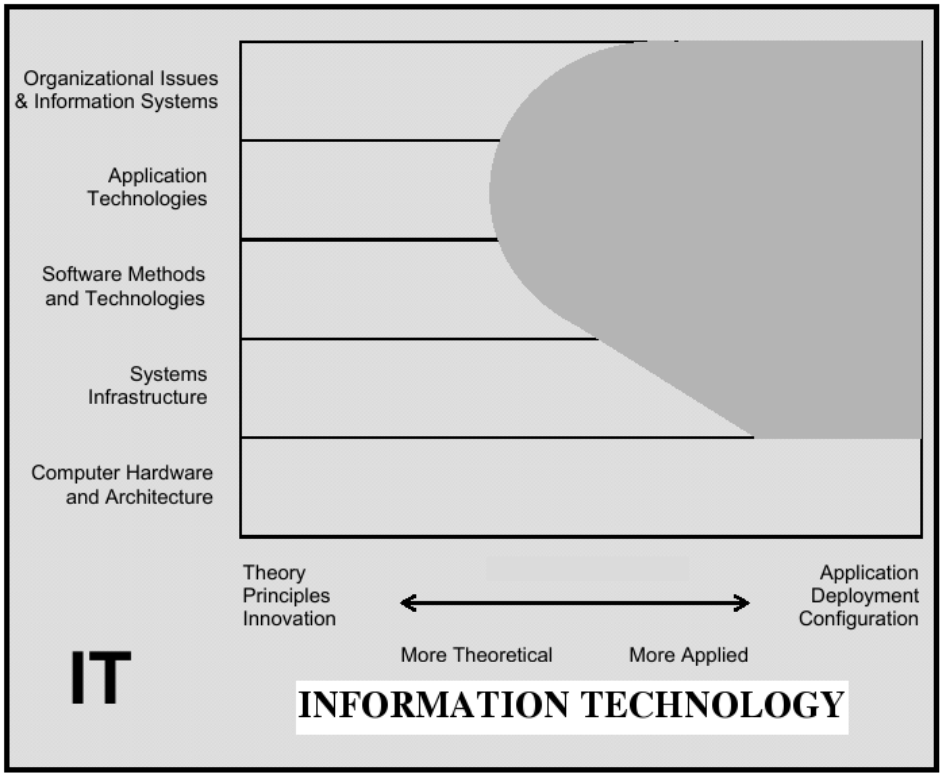
- Computer Science



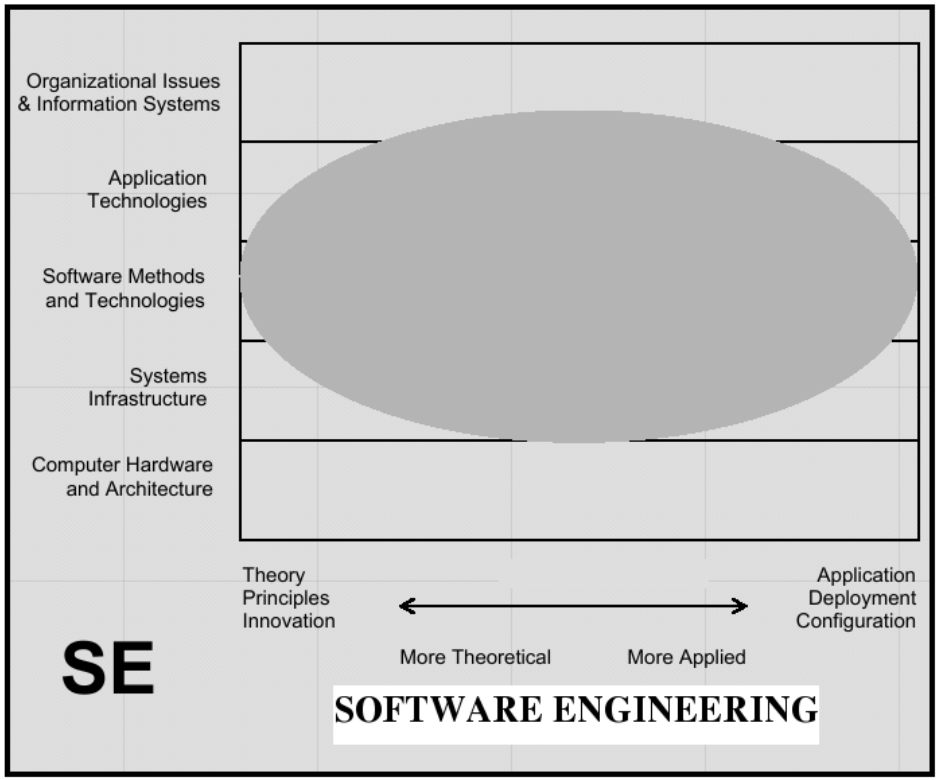
- Information Systems



- Information Technology



- Software Engineering



Conclusion

- Students who want a computing career may focus on programs such as:

- **Computer Science :** Serve those who wish to proceed as generalists in computing or who aspire for graduate study, research positions, or cross-disciplinary innovation.

- **Software Engineering :** Serve those who have the intellectual and technical aptitude to excel as software developers.

Conclusion...

- **Information Technology :** Serve those who are attracted to the widespread need for IT professionals in a variety of organizations.
- **Information Systems :** Serve those who want a career that focuses on the information needs of organizations and who are interested in technology primarily as a vehicle to meet such needs.
- **Computer Engineering :** Serve those who want a career that is focused on developing computer based devices.

References

1. **Computing Curricula 2005: The Overview Report.** A co-operative project of The Association for Computing Machinery(ACM), The Association for Information Systems(AIS), and The Computer Society(IEEE-CS). http://www.acm.org/education/curricula.html

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3. Allen B.Tucker, Editor. **Handbook of Computer Science and Engineering.** CRC Press, 1996.

THANK YOU