Good News

...for software engineers

Yes, software engineering is REAL engineering

If you or someone you know is an engineering graduate working in the software field, you may be eligible for licensing as a professional engineer–even if you lack work experience in the same field as your engineering degree.

Under PEO assessment criteria designed for people like you, you may be eligible to become a P.Eng. based on your experience in software development and design, if you meet other specific requirements.

For a copy of PEO's new brochure ***Licensing as a Professional Engineer: Answers to Frequently Asked Questions for Software Practitioners,*** check PEO's website at **www.peo.on.ca,** or contact:

Professional Engineers Ontario
Tel: (416) 224-1100 or 1-800-339-3716
Fax: (416) 224-8168 or 1-800-268-0496
email: webmaster@peo.on.ca

Professional Engineers
Ontario

Today's Lecture

1. Intro to Software Engineering
2. Inexact quantities
3. Error propagation
4. Floating-point numbers
5. Design process
6. Teamwork
7. Project planning
8. Decision making
9. Professional Engineering
10. Software quality - no web review
11. Software safety
12. Intellectual property

Approaches to Software Quality

- Focus on the product
- Focus on the process to build the product
- Focus on the people who build the product
  - Software engineering education
  - Licensing of software engineers

SE Education

In Canada,

- Engineering programs are accredited by the Canadian Engineering Accreditation Board (CEAB) - a board of the Canadian Council of Professional Engineers (CCPE).

- Computer science programs are accredited by the Computer Science Accreditation Board (CSAC) - an autonomous body of the Computer Information Processing Society (CIPS).

SE Education

CEAB criteria

- 0.5 years of mathematics
- 0.5 years of basic (natural) sciences
- 2.0 years of engineering sciences and design
- 0.6 years of complementary studies (incl. engineering economics)

CSAC criteria

- 1.5 years of computer science/computer engineering
- 0.5 years of mathematics/statistics
- 1.0 years of subjects outside of computing and math

UW SE curriculum

- 1.6 computer science/computer engineering
- 0.8 software engineering
- 0.5 years of mathematics/statistics
- 0.5 years of natural sciences (2 physics + general electives)
- 0.6 complementary studies

Licensing vs. Certification

- The general purpose of *certification* and *licensing* is to verify and provide assurances about the competency of those being certified/licensed.

- Provincial and state governments *mandate* the *licensing* of certain professionals who are legally required to practice at a level consistent with public safety (doctors, lawyers, professional engineers).

Licensing vs. Certification

- A professional society may *voluntarily* operate a *certification program* to authenticate practitioners' competency and to inspire public confidence in the profession.

  CIPS Information Systems Professional (I.S.P.)

  IEEE Software Engineering Certification

- Some software companies offer product- or vendor-specific certifications that assess a user's proficiency in using the company's products.

Professional Engineers (P.Eng.)

In Ontario, any practising engineer must be *licensed* as a P.Eng.

Anyone who practises engineering without a license or a temporary license is guilty of an offense and may be fined.

Most provinces define “engineering” by *practice* (what an engineer does) rather than by *title*

Professional Engineers Act

In Ontario, the practice of professional engineering is defined in the **Professional Engineers Act** and comprises three tests:

1. Any act of *designing, composing, evaluating, advising, reporting, directing or supervising*

2. Wherein the *safeguarding of life, health, property or the public welfare* is concerned

3. Requires the *application of engineering principles*, but does not include practising as a natural scientist.

Professional Engineers Act, Revised Statutes of Ontario, 1990, Chapter P.28

Professional Engineers (P.E.) in U.S.

Licensing is *mandatory* for any professional who

- *Offers engineering services directly to the public*
- Participates in the design of facilities, roads, etc.,

where drawings must be submitted to state agencies for approval

Most engineers are not licensed in the States:

- They work for a *company* or the *federal government.*
- Their practice is limited to *company/government work.*
- They do not use the engineering title outside of work.
- They do not sell services to another party.

Enforcement Varies

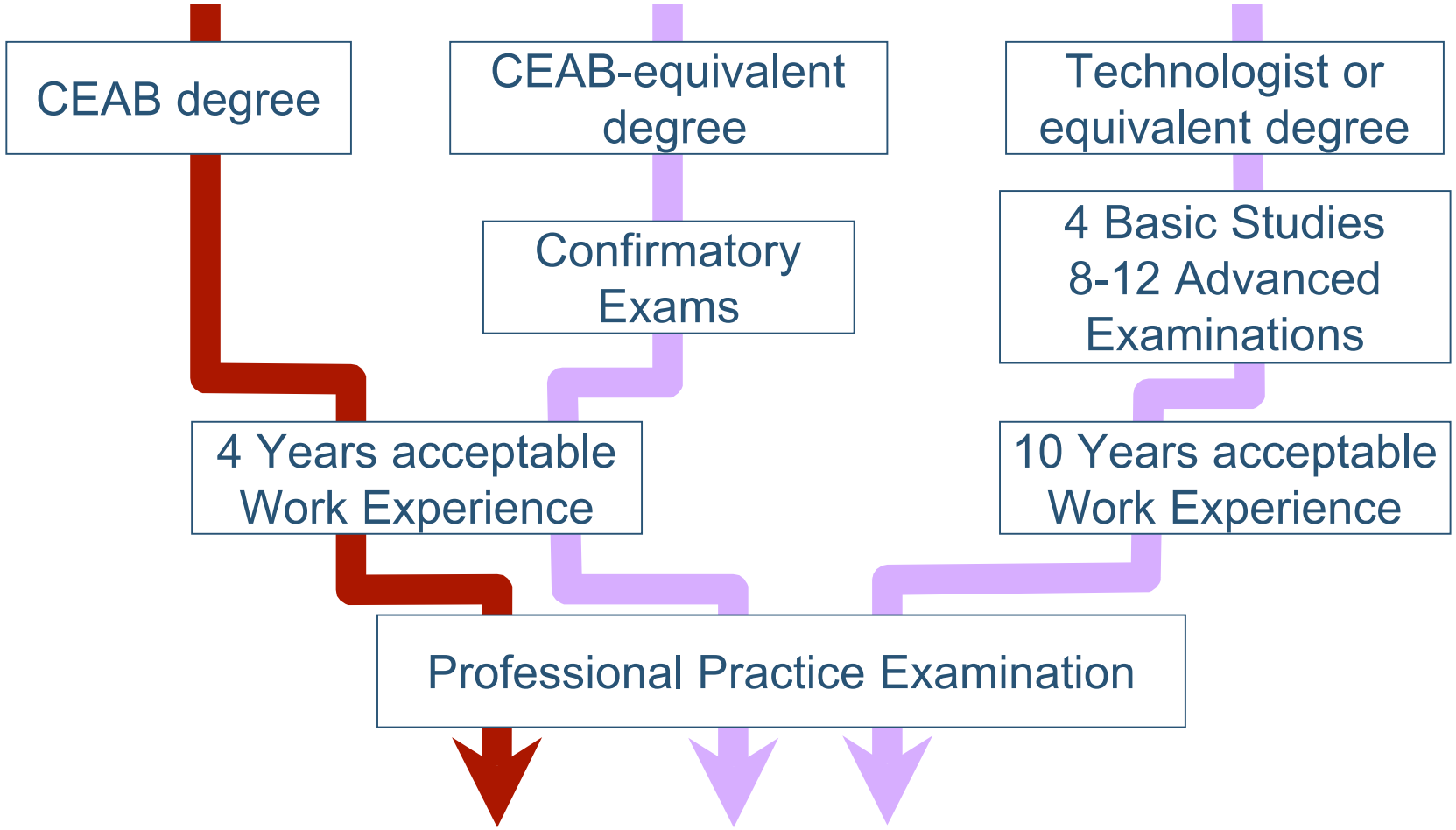
The PEO does not have the resources to enforce the licensing of every practicing engineer

Licensing (and enforcement) is most prevalent among civil engineers — for reasons that would affect software engineers

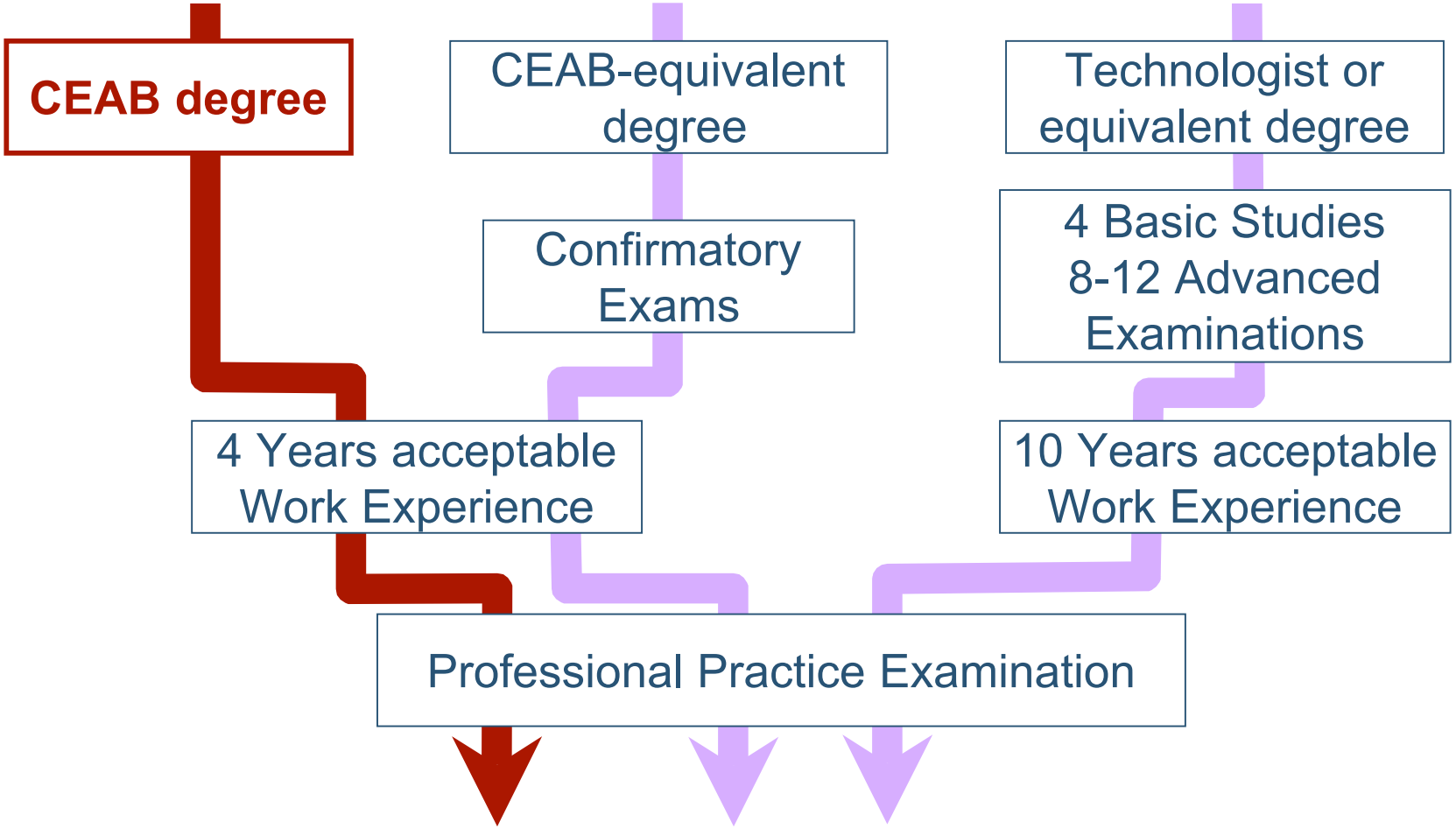
- They deal with government employees
- They sell their services directly to the public

Neither of whom can be expected to assess quality of the engineer's products or processes

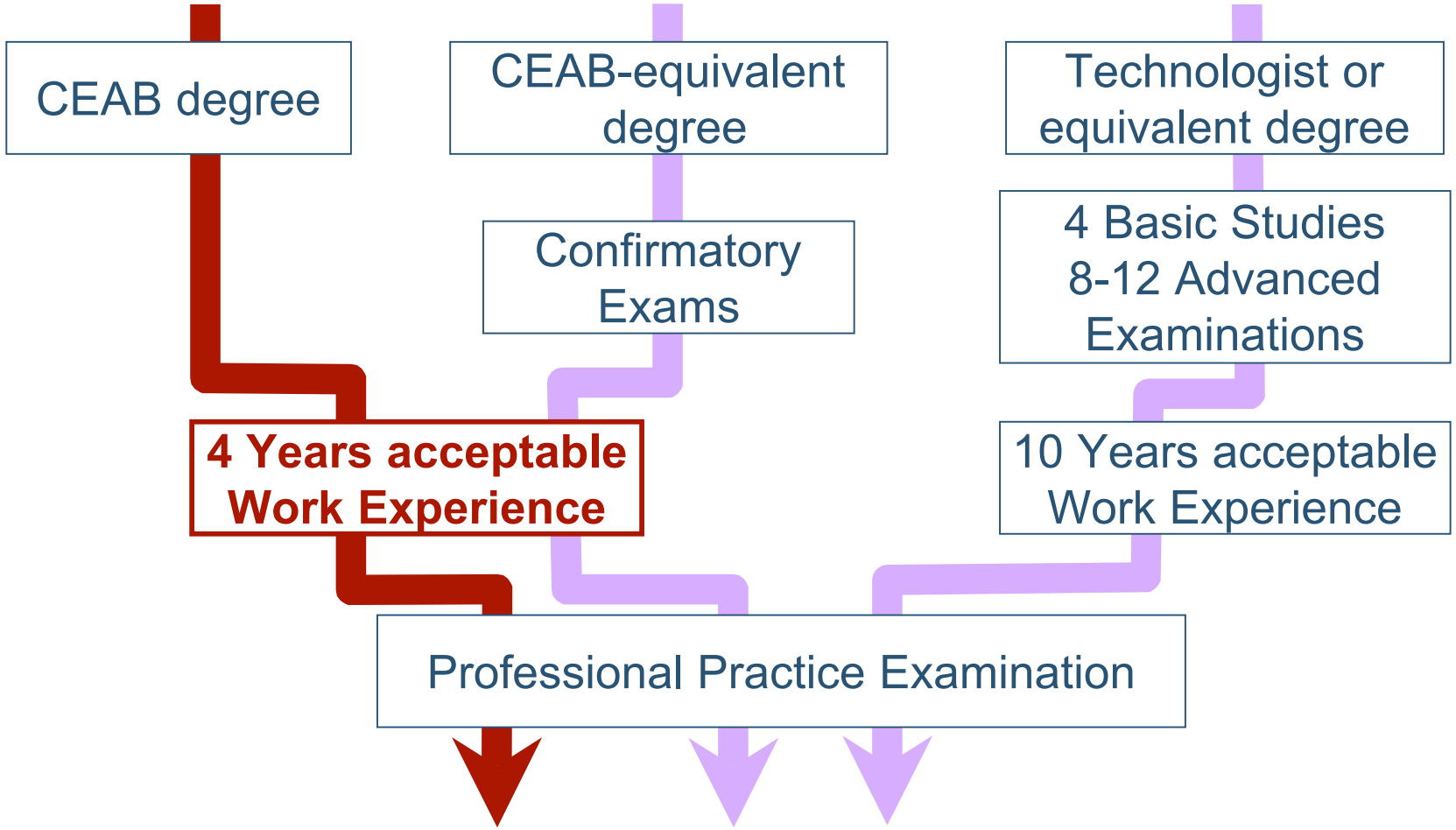
P.Eng. Application Process



P.Eng. Application Process



P.Eng. Application Process



Work Experience

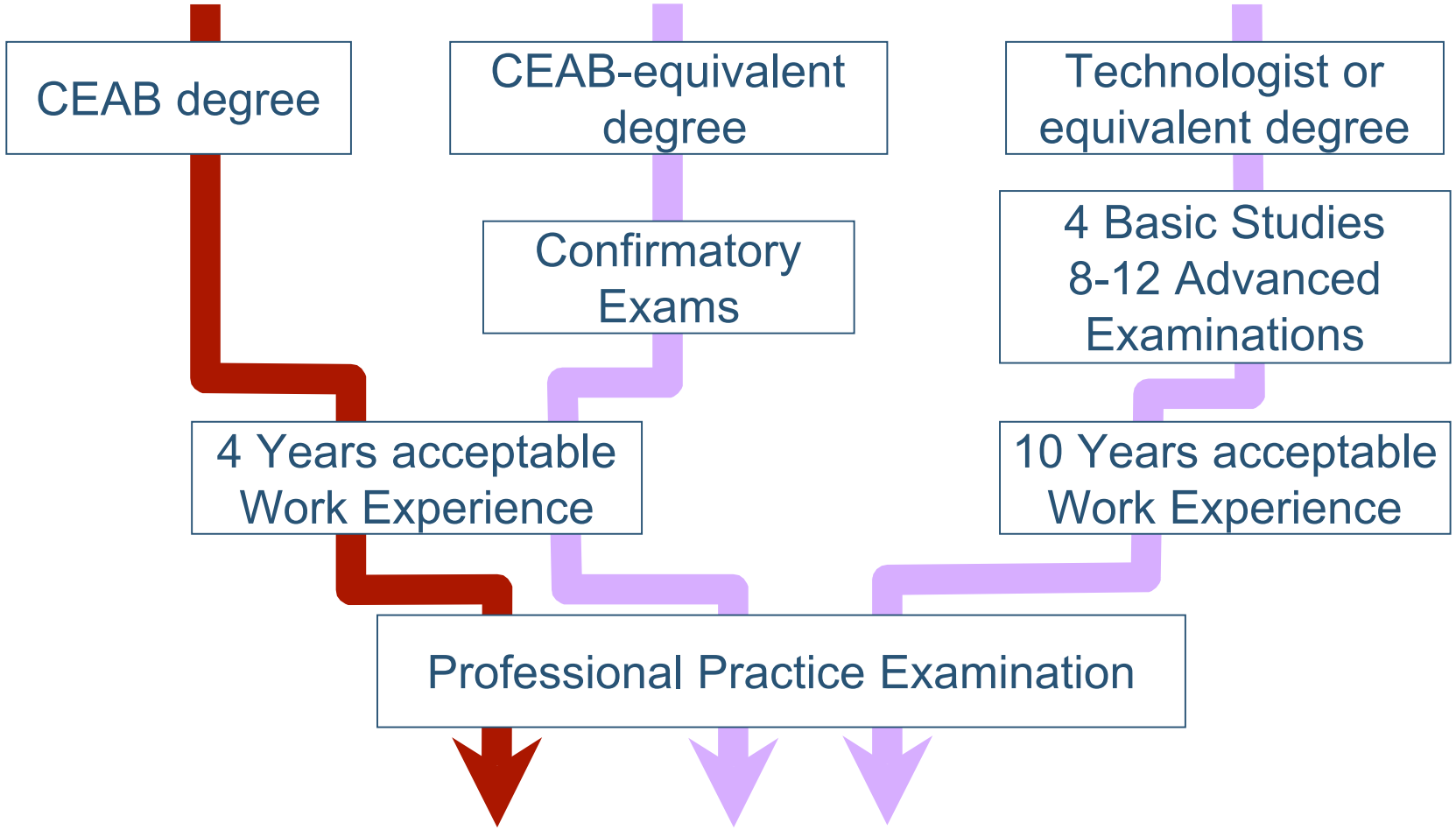
Nascent professionals need to *practice* applying their knowledge before they are prepared to take *primary responsibility* for performing work in their field.

P.Eng. (Canada) - 4 years engineering experience*

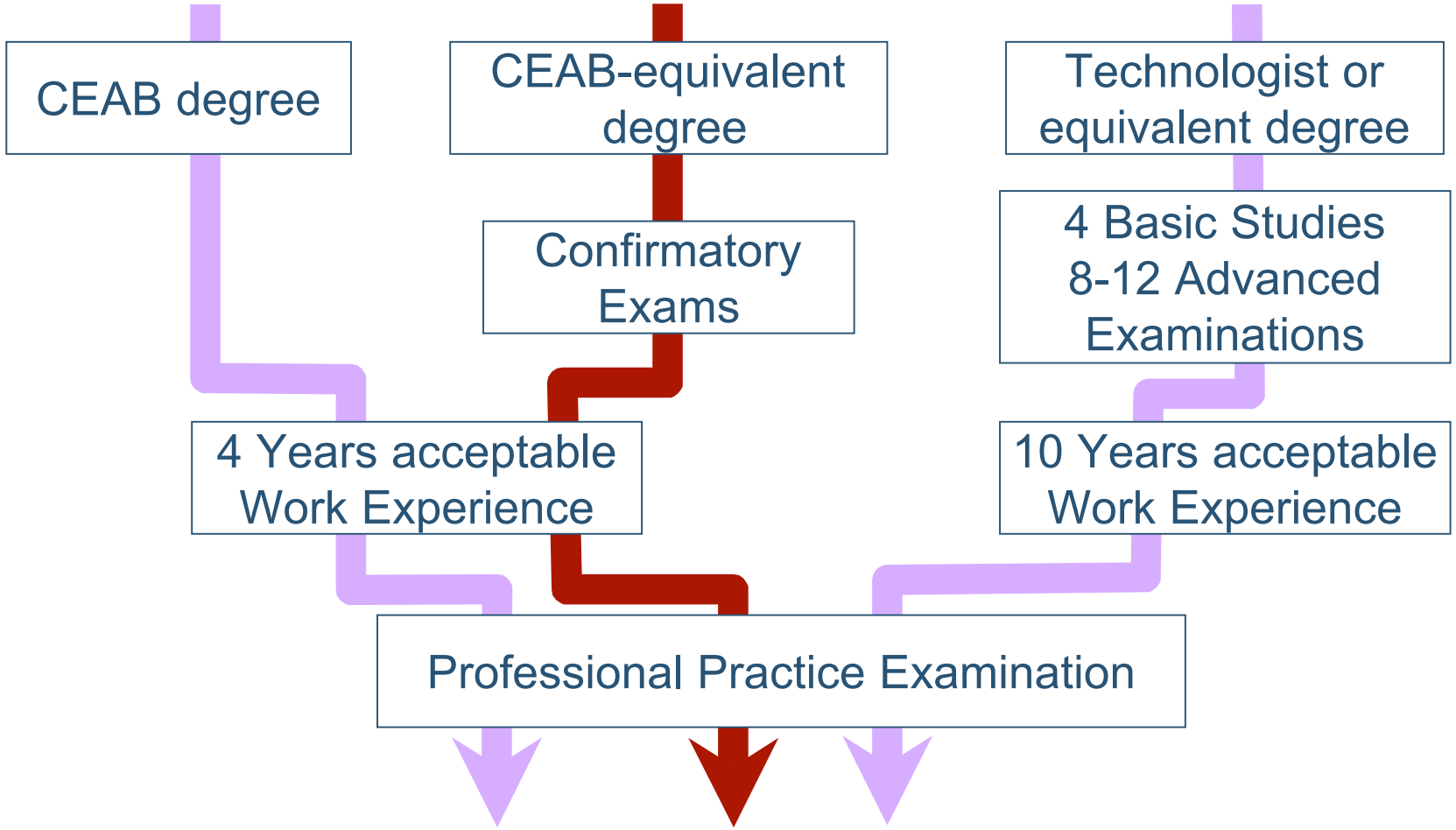
- In the same field of engineering as your education
- In Canada, under the supervision of a P.Eng. (1 year)
- After graduation (3 years)
- Up to one year credit for post-graduate studies
- Up to one year credit for co-op work

*Assuming you graduate from an accredited engineering program

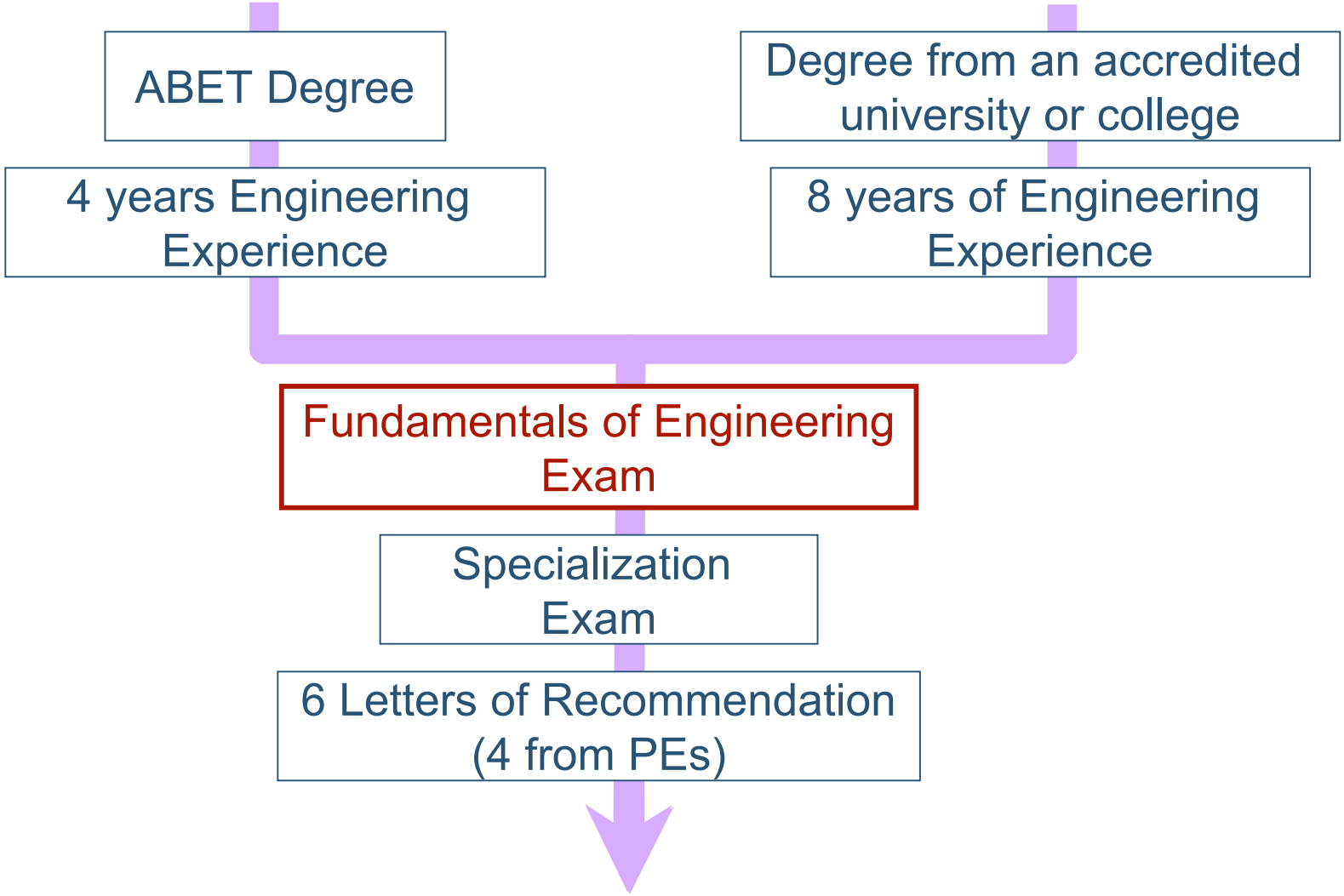
P.Eng. Application Process



P.Eng. Application Process



P.E. Application Process (U.S.)



P.E. Application Process (U.S.)

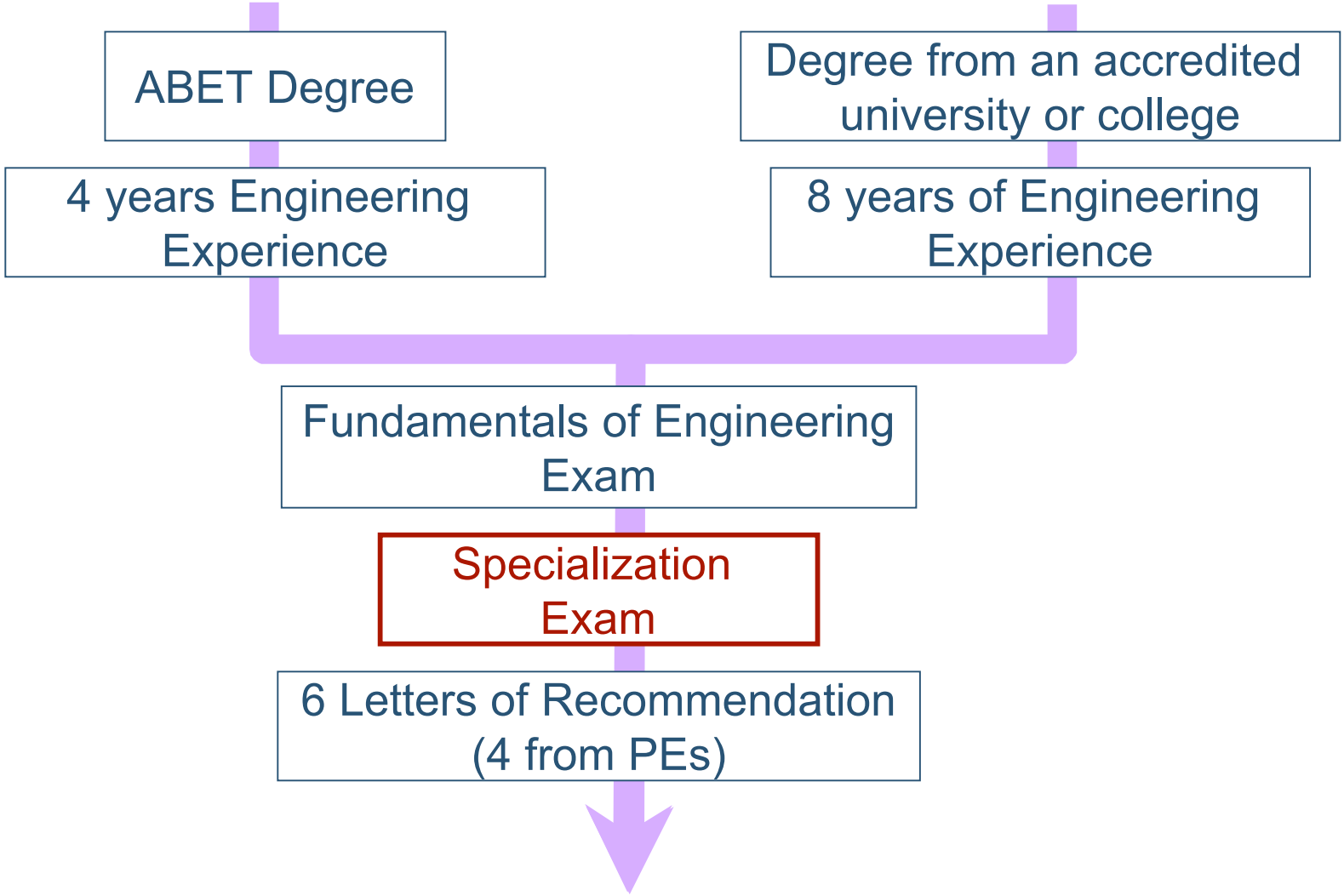
Fundamentals of Engineering Exam covers material based on the first two years of an ABET accredited program:

Chemistry, Computers, Dynamics, Electrical circuits, Engineering economics, Ethics, Fluid mechanics, Material science, Mathematics, Mechanics of materials, Statics, Thermodynamics

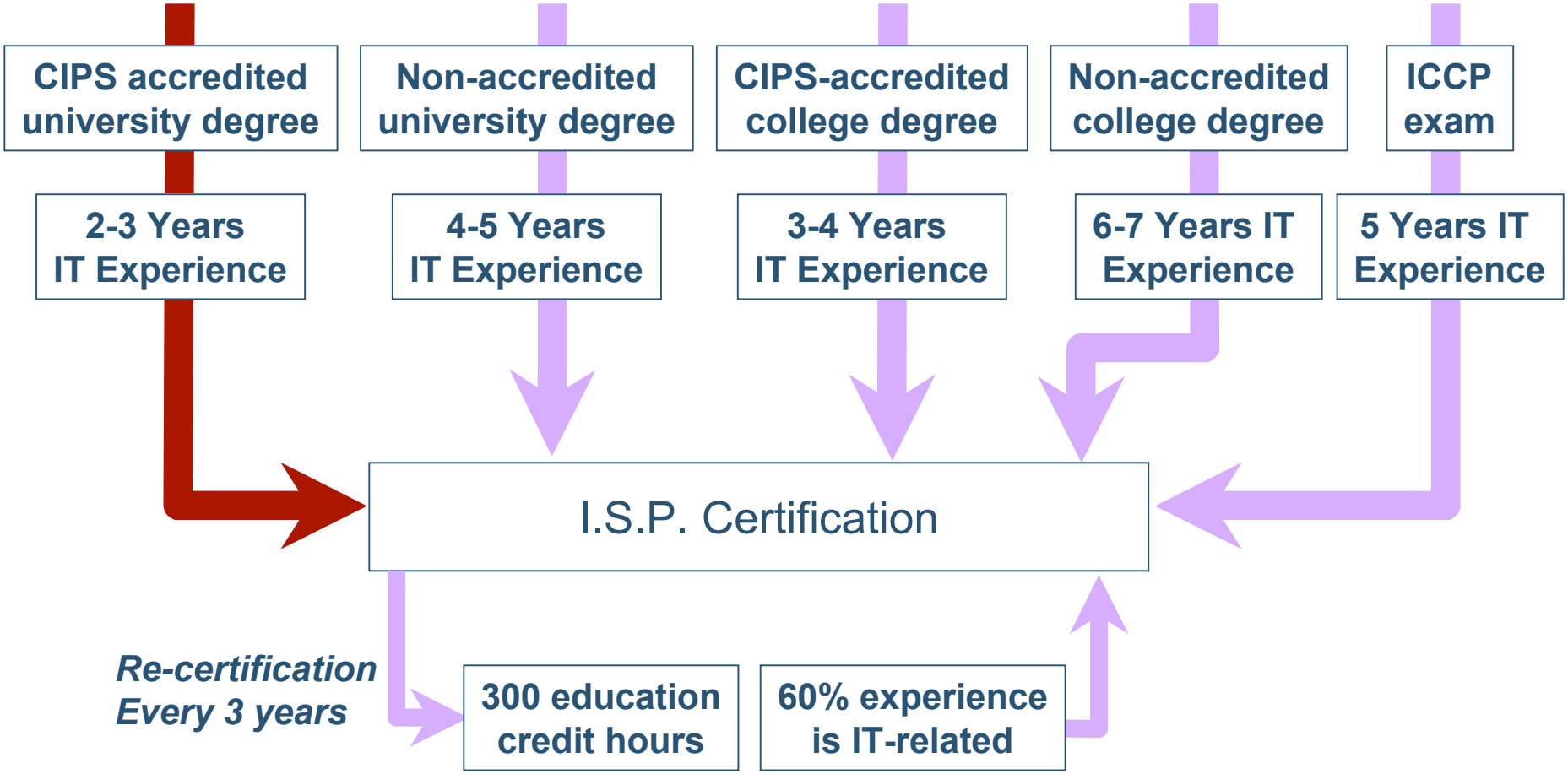
Discipline Specific Examination covers material based on the last two years of an ABET accredited program:

- Five disciplines: civil, chemical, industrial, mechanical, electrical
- One non-specific: covers the same material as the general exam, but in more depth

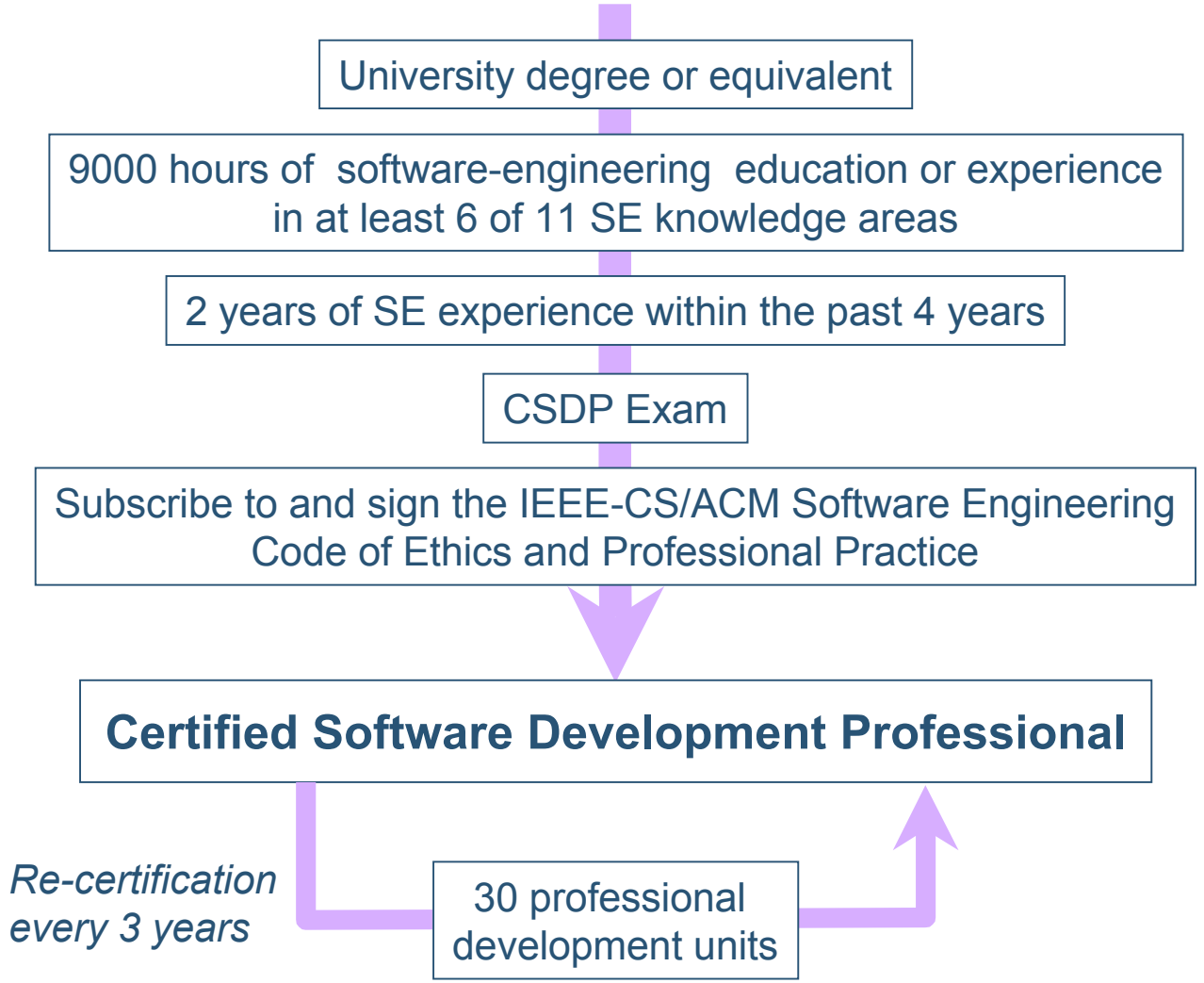
P.E. Application Process (U.S.)



I.S.P. Certification Process



Certified Software Development Prof.



Long-term Forecast

- Within your professional lifetime, the development of some software systems will be restricted to P.Eng.s who are competent to practice software engineering.
  - safety-critical software
  - software components in engineered products
  - software that models or controls the physical world

- Licensing of software engineers will become serious only when the public demands it
  - possibly after the catestrophic failure of some software system

Any questions about accreditation, certification, or licensing?

Code of Ethics

A **code of ethics** describes the ethical and professional obligations against which peers, the public, and legal bodies can measure a [professional's] behaviour.

Don Gotterbarn, "How the New Software Engineering Code of Ethics Affects You", IEEE Software, November/December 1999

- Stimulates *ethical conduct*
- Provides support against unethical behaviour
- Inspires *public confidence* in the profession
- Serves as a formal basis for *disciplining* professionals

Code of Ethics

- Basic rules of *integrity* and *fairness*
  (e.g., "loyalty to the practitioner's associates, employers, clients, subordinates, and employees.")

- Professional rules of *responsibility* to those they serve
  (e.g., "disclose immediately to the practitioner's client any interest … that might be construed as prejudicial … to the professional judgment of the practitioner… .")

- Profession-specific rules that *designate best practices*
  (e.g., "ensure adequate testing, debugging, and review of software and related documents")

Code of Ethics

PEO Code of Ethics

- duty to society
- duty to employer(s)
- duty to clients
- duty to colleagues, employees
- duty to engineering profession
- duty to oneself

PEO Professional Misconduct

- negligence
- harassment
- failure to safeguard the safety, health, or property of user
- failure to comply with statutes, regulations, standards, rules, etc.
- signing or sealing document that professional did not prepare or check
- failure to disclose conflict of interest
- performing task outside one's area of expertise

Code of Ethics

ACM/IEEE Software Engineering Code of Ethics and Professional Practice

- duty to public
- duty to client and employer
- duty to meet highest standards
- duty to maintain integrity and and independence in judgment
- duty to ethical management
- duty to profession
- duty to colleagues
- duty to self

Professional Development

On-going professional education maintains or improves practitioners' knowledge and skills after they begin professional practice.

- Canadian Society for Electrical and Computer Engineering (CSECE)
- Association for Computing Machinery (ACM)
  Communications of the ACM
- Institute for Electrical and Electronic Engineers (IEEE)
  IEEE Software
  IEEE Computer

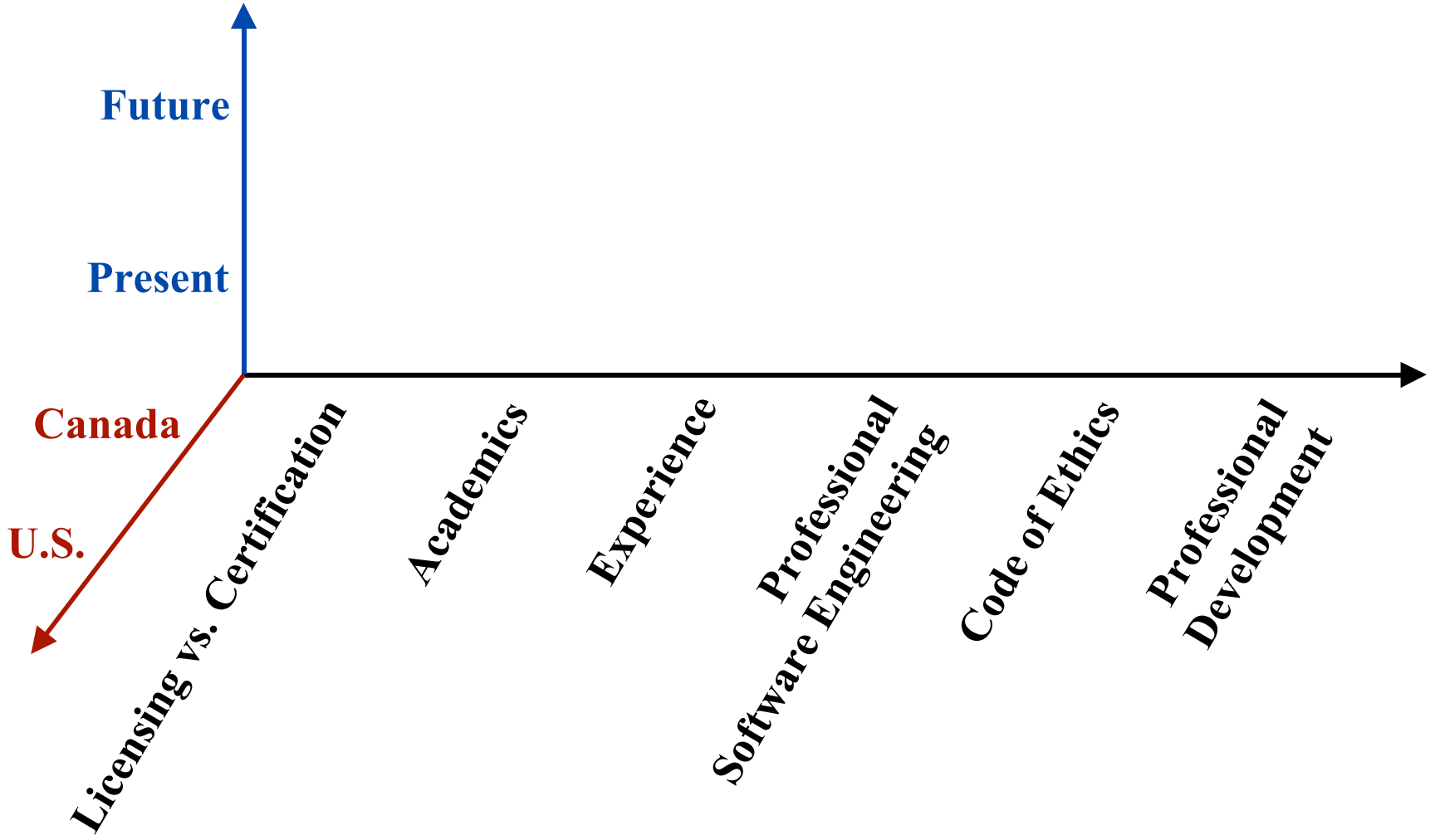
IEEE Technical Societies

IEEE Aerospace and Electronic Systems Society
IEEE Antennas and Propagation Society
IEEE Broadcast Technology Society
IEEE Circuits and Systems Society
IEEE Communications Society
IEEE Components Packaging, and Manufacturing Technology Society
IEEE Computational Intelligence Society
IEEE Computer Society
IEEE Consumer Electronics Society
IEEE Control Systems Society
IEEE Council on SuperConductivity
IEEE Dielectrics and Electrical Insulation Society
IEEE Education Society
IEEE Electromagnetic Compatibility Society
IEEE Electron Devices Society
IEEE Engineering Management Society
IEEE Engineering in Medicine and Biology Society
IEEE Geoscience & Remote Sensing Society
IEEE Industrial Electronics Society
IEEE Industry Applications Society
IEEE Information Theory Society
IEEE Intelligent Transportation Systems Council
IEEE Instrumentation and Measurement Society
IEEE Lasers & Electro-Optics Society
IEEE Magnetics Society
IEEE Microwave Theory and Techniques Society
IEEE Nanotechnology Council
IEEE Nuclear and Plasma Sciences Society
IEEE Oceanic Engineering Society
IEEE Power Electronics Society
IEEE Power Engineering Society
IEEE Product Safety Engineering Society
IEEE Professional Communication Society
IEEE Reliability Society
IEEE Robotics & Automation Society
IEEE Sensors Council
IEEE Signal Processing Society
IEEE Society on Social Implications of Technology
IEEE Solid-State Circuits Society
IEEE Systems, Man, and Cybernetics Society
IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society
IEEE Vehicular Technology Society

IEEE Computer Publications

IEEE Transactions on Computers
IEEE/ACM Transactions on Computational Biology & Bioinformatics
IEEE Transactions on Dependable & Secure Computing
IEEE Transactions on Information Technology in Biomedicine
IEEE Transactions on Knowledge and Data Engineering
IEEE Transactions on Mobile Computing
IEEE Transactions on Multimedia
IEEE Transactions on Nanobioscience
IEEE Transactions on Networking
IEEE Transactions on Parallel and Distributed Systems
IEEE Transactions on Patterns Analysis and Machine Intelligence
IEEE Transactions on Software Engineering
IEEE Transactions on Very Large Scale Integration (VLSI) Systems
IEEE Transactions on Visualization and Computer Graphics
IEEE Transactions on Networking
Computing in Science & Engineering
IEEE Annals of the History of Computing
IEEE Computer
IEEE Computer Graphics & Applications
IEEE Design & Test of Computers
IEEE Intelligent Systems
IEEE Internet Computing
IEEE Micro
IEEE MultiMedia
IEEE Pervasive Computing
IEEE Security & Privacy
IEEE Software
IT Professional

Summary


Future
Present
Canada
U.S.
Licensing vs. Certification
Academics
Experience
Professional Software Engineering
Code of Ethics
Professional Development

Announcements

Simulator Code due tomorrow by 4:30 (electronic submission)

Robot Demonstrations and Races in lab on Thursday

Simulation Demonstrations Thursday and Friday

Reduced Office Hours on Thursday (due to Simulation Demos)