

# **CS 4530**

# **Fundamentals of Software Engineering**

## **Lecture 12.2: Ethics in Software Engineering**

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# Learning Objectives for this Lesson

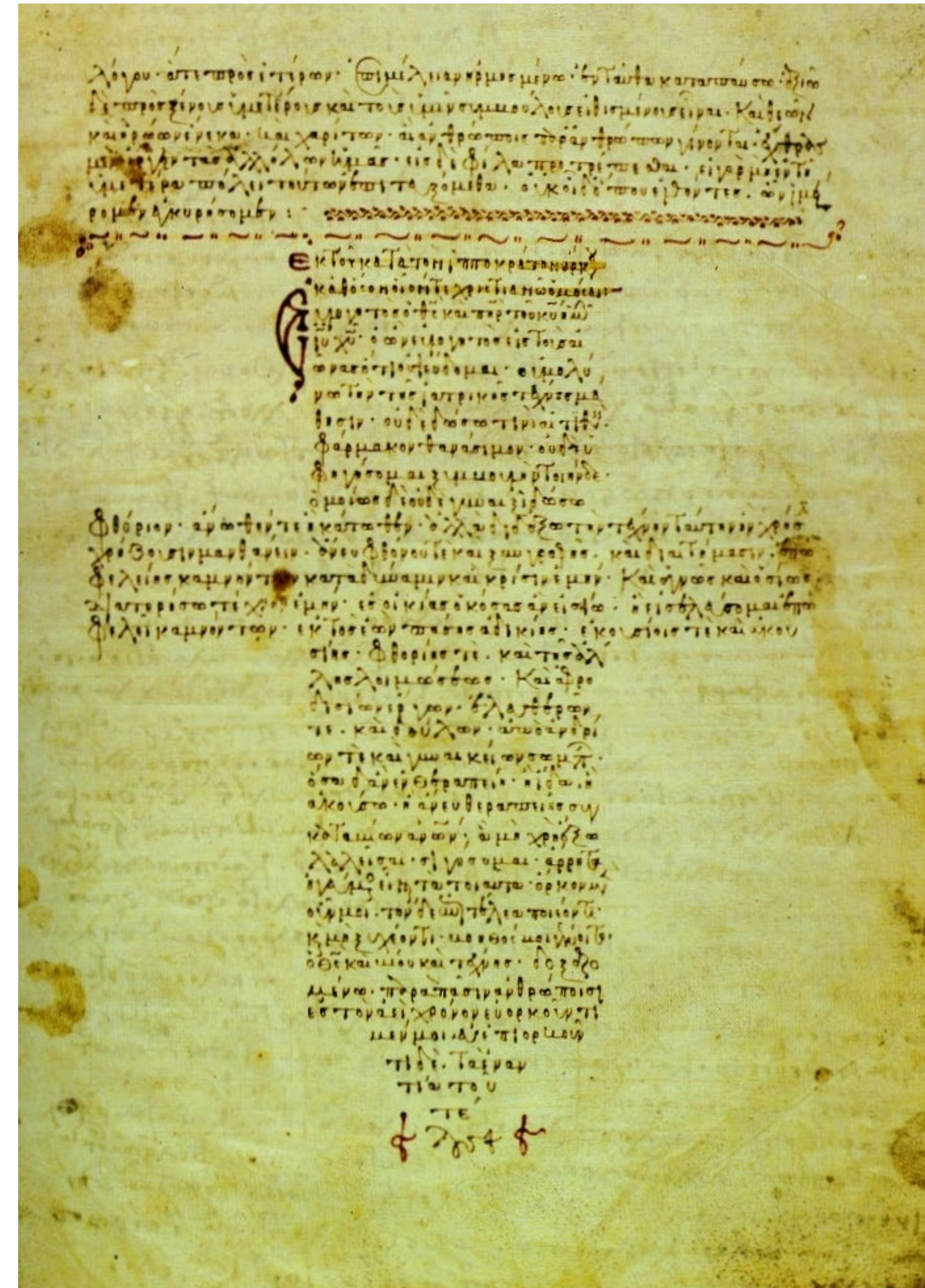
**By the end of this lesson, you should be able to...**

- Explain several of the meanings of “the public interest”.
- List some sources of ethical guidance for a software engineer.
- List several things that a software engineer can do to try to behave in an ethical manner.

# Professional Ethics

## Professional standards

- By 1675, standards established for: divinity, law, medicine
- Professionals exercise specialist knowledge or skill - professional ethics governs how this knowledge should be governed



12th-century Byzantine manuscript of the Hippocratic Oath

# Code of Ethics

## Professional Engineers

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.



# Code of Ethics

## Professional Engineers: Citigroup Center

- Design met building code, but did *not* account for all failure modes
- Last-minute changes to construction increased odds of failure
- Fixed before disaster could strike, but kept a secret for 20 years



# Badly-engineered software can kill people

## Therac-25 (1985-1987)

- Bug in software caused 100x greater exposure to radiation than intended
- At least 6 died
- Likely far more suffered: deaths occurred over a period of 2 years!
- Weak accountability in manufacturer's organization



“Therac-25” by Catalina Márquez, Wikimedia commons, CC BY-SA 4.0

# Code of Ethics

## ACM's Code of Ethics Software Engineers

1. PUBLIC – Software engineers shall act consistently with the public interest.

2. CLIENT AND EMPLOYER – Software engineers shall act in a manner that is in the best interests of their client and employer.

3. PUBLIC – Software engineers shall act consistently with the public interest.

4. JUDGMENT – Software engineers shall maintain integrity and independence in their professional judgment.

5. MANAGEMENT – Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.

6. PROFESSION – Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.

7. COLLEAGUES – Software engineers shall be fair to and supportive of their colleagues.

8. SELF – Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

# Unpacking “Public Interest”

1. PUBLIC – Software engineers shall act consistently with the public interest.

## Do no harm: how can our software cause harm?

- How can my software fail? What are the implications of that failure?
- Who will use my software, and how might different users use it differently?
- How will my software impact those who do not use it directly?
- Will my software amplify negative behavior for users and society at large?



# Unpacking “Public Interest”

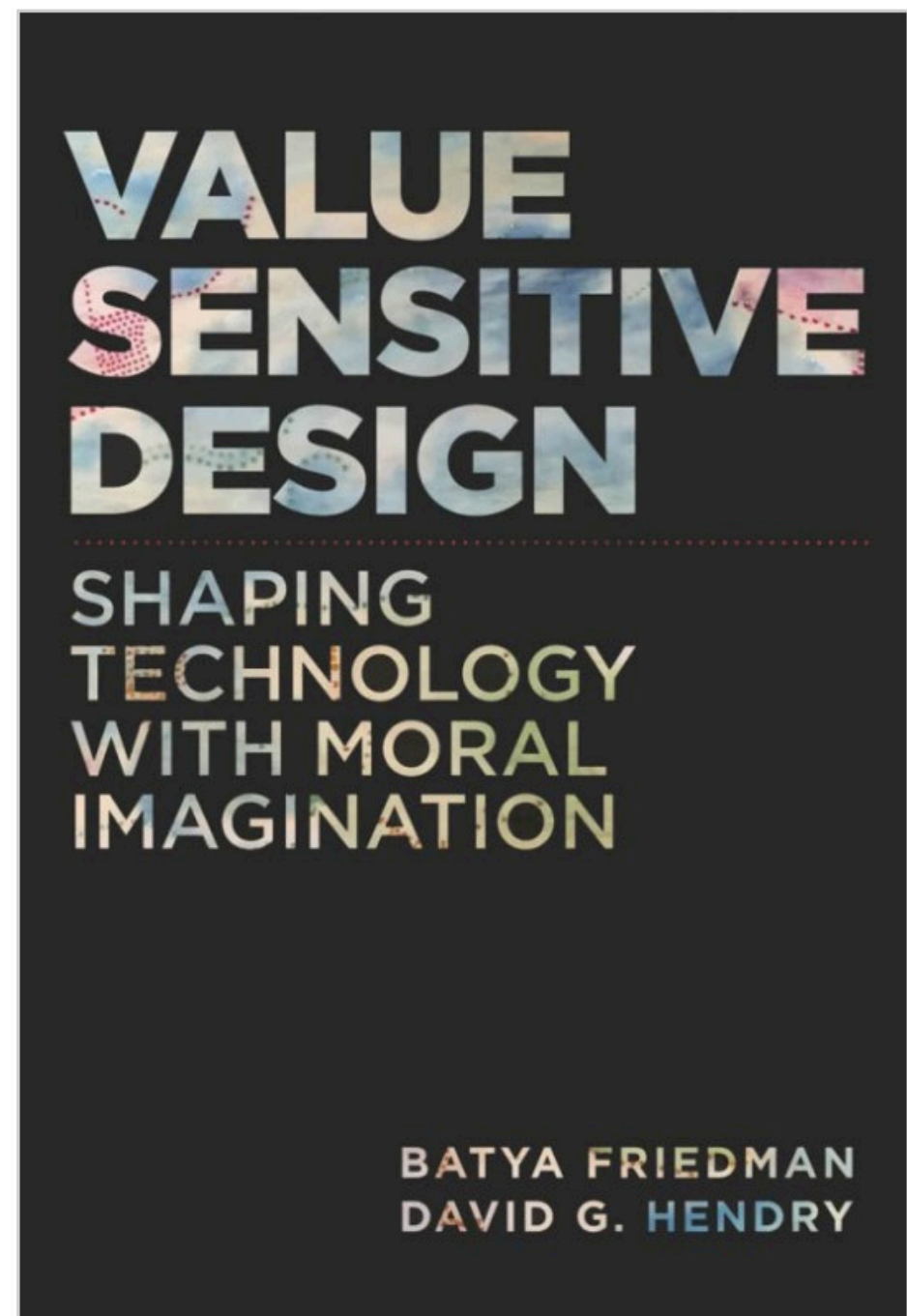
**How can our software make a positive contribution?**

- Can my software make people’s jobs easier?
- Can my software make people happier?
- Can my software amplify positive behavior for users and society at large?
- How can my software better achieve these goals?

# Unpacking “Public Interest”

## What values might our software promote or diminish?

- Human rights - Inalienable, fundamental rights to which all people are entitled
- Accessibility - Making all people successful users of the technology
- Justice - Procedural justice (process is fair) + distributive justice (outcomes are fair)
- Privacy - An individual’s agency in determining what information about them is shared
- Human welfare - Physical, material and psychological well-being



# Does ACM's Code of Ethics Change Ethical Decision Making in Software Development?

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**TLDR: No**

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## ABSTRACT

Ethical decisions in software development can substantially impact end-users, organizations, and our environment, as is evidenced by recent ethics scandals in the news. Organizations, like the ACM, publish codes of ethics to guide software-related ethical decisions. In fact, the ACM has recently demonstrated renewed interest in its code of ethics and made updates for the first time since 1992. To better understand how the ACM code of ethics changes software-

The first example is the Uber versus Waymo dispute [26], in which a software engineer at Waymo took self-driving car code to his home. Shortly thereafter, the engineer left Waymo to work for a competing company with a self-driving car business, Uber. When Waymo realized that their own code had been taken by their former employee, Waymo sued Uber. Even though the code was not apparently used for Uber's competitive advantage, the two companies settled the lawsuit for \$245 million dollars.

# Standards can give more concrete guidance.

- International bodies define standard processes that are designed to protect the public
- By (correctly) following such a standard, you can reduce the chance of harm to users, as well as your ethical (and legal) liability

INTERNATIONAL  
STANDARD

IEC  
62304

First edition  
2006-05

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Medical device software –  
Software life cycle processes

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number  
IEC 62304:2006(E)

# Standards can give more concrete guidance.

The screenshot shows the FAA website with a green banner at the top containing COVID-19 information. Below the banner is the United States Department of Transportation logo and the FAA logo. The main navigation bar includes links for About, Jobs, News, and a search box. A secondary navigation bar lists various FAA categories: AIRCRAFT, AIR TRAFFIC, AIRPORTS, PILOTS & AIRMEN, DATA & RESEARCH, REGULATIONS, SPACE, and DRONES. The breadcrumb trail reads: FAA Home > Aircraft > Aircraft Certification > Design Approvals. The left sidebar contains a menu for Aircraft Certification, with Design Approvals selected. The main content area features the title "Aircraft Certification Software and Airborne Electronic Hardware" and a detailed paragraph explaining the FAA's role in approving software and hardware for airborne systems. Below this is a "Top Tasks" sidebar with links to various services. At the bottom, there is an "Email List Update" section and a "FAA CONTINUED OPERATIONAL SAFETY" banner.

The latest general information on the Coronavirus (COVID-19) is available on [Coronavirus.gov](https://www.cdc.gov/coronavirus). For FAA-specific COVID-19 resources, please visit [faa.gov/coronavirus](https://www.faa.gov/coronavirus).

United States Department of Transportation

Federal Aviation Administration

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AIRCRAFT AIR TRAFFIC AIRPORTS PILOTS & AIRMEN DATA & RESEARCH REGULATIONS SPACE DRONES

FAA Home > Aircraft > Aircraft Certification > Design Approvals

Aircraft Certification

- Aircraft Registration
- Airworthiness Certification
- Continued Operational Safety
- Design Approvals**
- Engines and Propellers
- Field Approvals & Supplemental Type Certificates (STCs)
- Rotorcraft
- Small Airplanes
- Supplemental Type Certificates
- International
- Locate an Office
- Production Approvals
- Senior Technical Experts Program (STEP)

Aircraft Safety

General Aviation & Recreational Aircraft

Repair Stations

## Aircraft Certification Software and Airborne Electronic Hardware

The Aircraft Certification Service is concerned with the approval of software and airborne electronic hardware for airborne systems (e.g., autopilots, flight controls, engine controls), as well as that used to produce, test, or manufacture equipment to be installed on airborne products. The FAA Aircraft Certification Service develops policy, guidance and training for software and airborne electronic hardware that has an effect on the airborne product (a "product" is an aircraft, an engine, or a propeller).

For a list of people you can contact for additional information regarding Aircraft Certification Software and Airborne Electronic Hardware activities, please visit the [Contacts](#) page.

### Email List Update

We are updating the email list used for notification of activities relating to airborne digital systems developed using software and airborne electronic hardware. To be added to the list, send an email to

### Top Tasks

- Get Form 337, Major Repair and Alteration
- Register an aircraft
- Look up an N-Number
- Review preliminary accident data
- Find aircraft safety alerts
- Search for SAIBs

**FAA CONTINUED OPERATIONAL SAFETY**

Continued operational safety ensures the integrity of a product throughout its service life, and includes mandatory requirements for modification, maintenance, inspection and corrective actions.

# Standards can give more concrete guidance.

## Example: Domino's + ADA

### Domino's Would Rather Go to the Supreme Court Than Make Its Website Accessible to the Blind

Rather than developing technology to support users with disabilities, the pizza chain is taking its fight to the top

by Brenna Houck | @EaterDetroit | Jul 25, 2019, 6:00pm EDT

f   SHARE

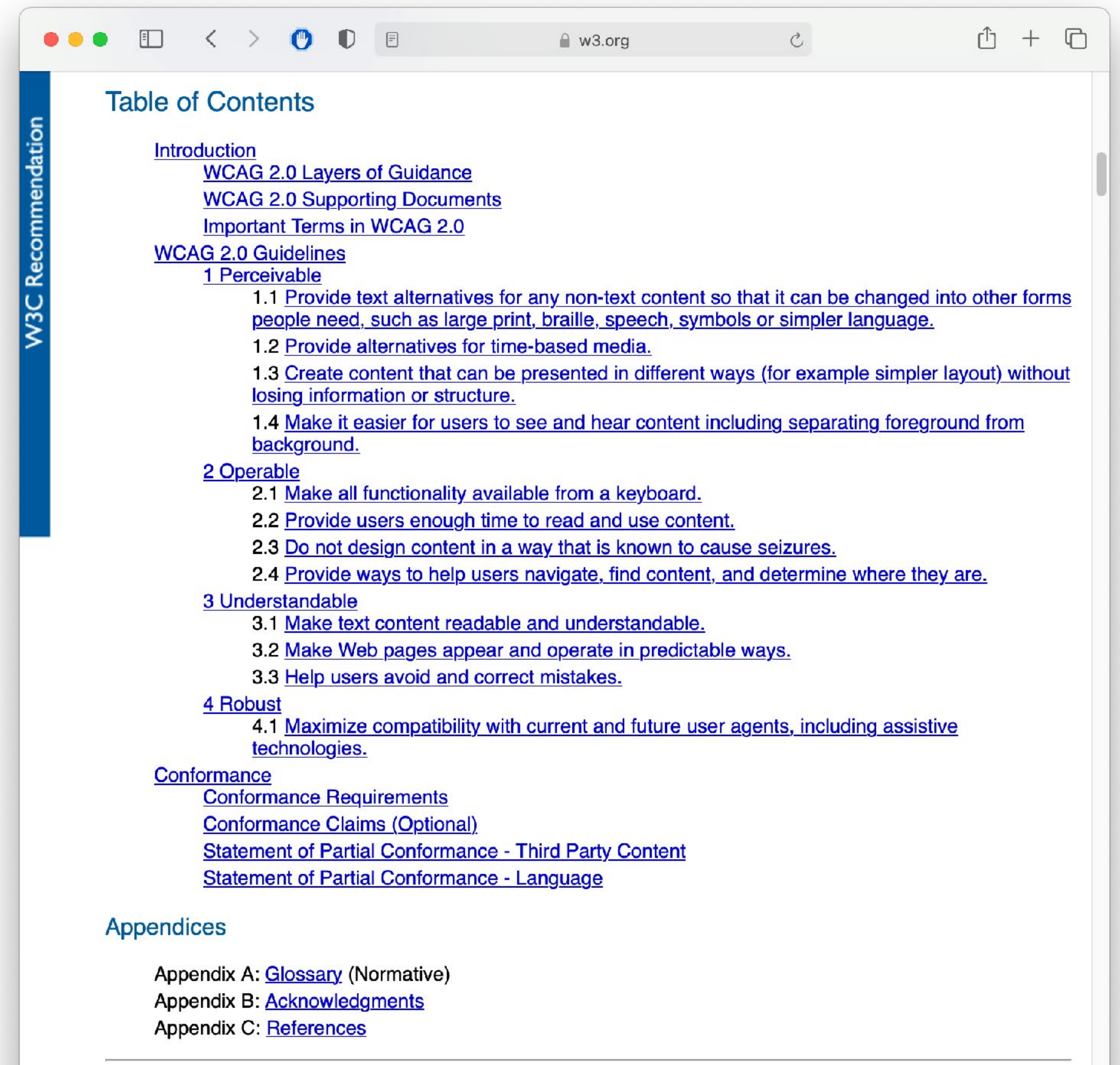


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- [WCAG 2.0 Guidelines](#)
  - [1 Perceivable](#)
    - [1.1 Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.](#)
    - [1.2 Provide alternatives for time-based media.](#)
    - [1.3 Create content that can be presented in different ways \(for example simpler layout\) without losing information or structure.](#)
    - [1.4 Make it easier for users to see and hear content including separating foreground from background.](#)
  - [2 Operable](#)
    - [2.1 Make all functionality available from a keyboard.](#)
    - [2.2 Provide users enough time to read and use content.](#)
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  - [3 Understandable](#)
    - [3.1 Make text content readable and understandable.](#)
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    - [3.3 Help users avoid and correct mistakes.](#)
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# But many ethical decisions are still hard

## Example: Social Media Platforms

- Social media platforms like Facebook, Twitter, or Tiktok can
  - Build communities across distance
  - Spread information for social action
  - Spread misinformation and disinformation
  - Amplify hate speech
- How to balance freedom vs regulation?



# The Curb Cut Effect





# Where does this leave us?

## So that we can sleep at night

- Consider the different ways that our software may impact others
- Consider the ways in which our software interacts with the political, social, and economic systems in which we and our users live
- Follow best practices, and actively push to improve them
- Encourage diversity in our development teams
- Engage in honest conversations with our co-workers and supervisors to explore possible ethical issues and their implications.

# Learning Objectives for this Lesson

**You should now be able to:**

- Explain several of the meanings of “the public interest”.
- List some sources of ethical guidance for a software engineer.
- List several things that a software engineer can do to try to behave in an ethical manner.