

# Foundations of Software Engineering

Part 26: Software Engineering Ethics

Christian Kästner



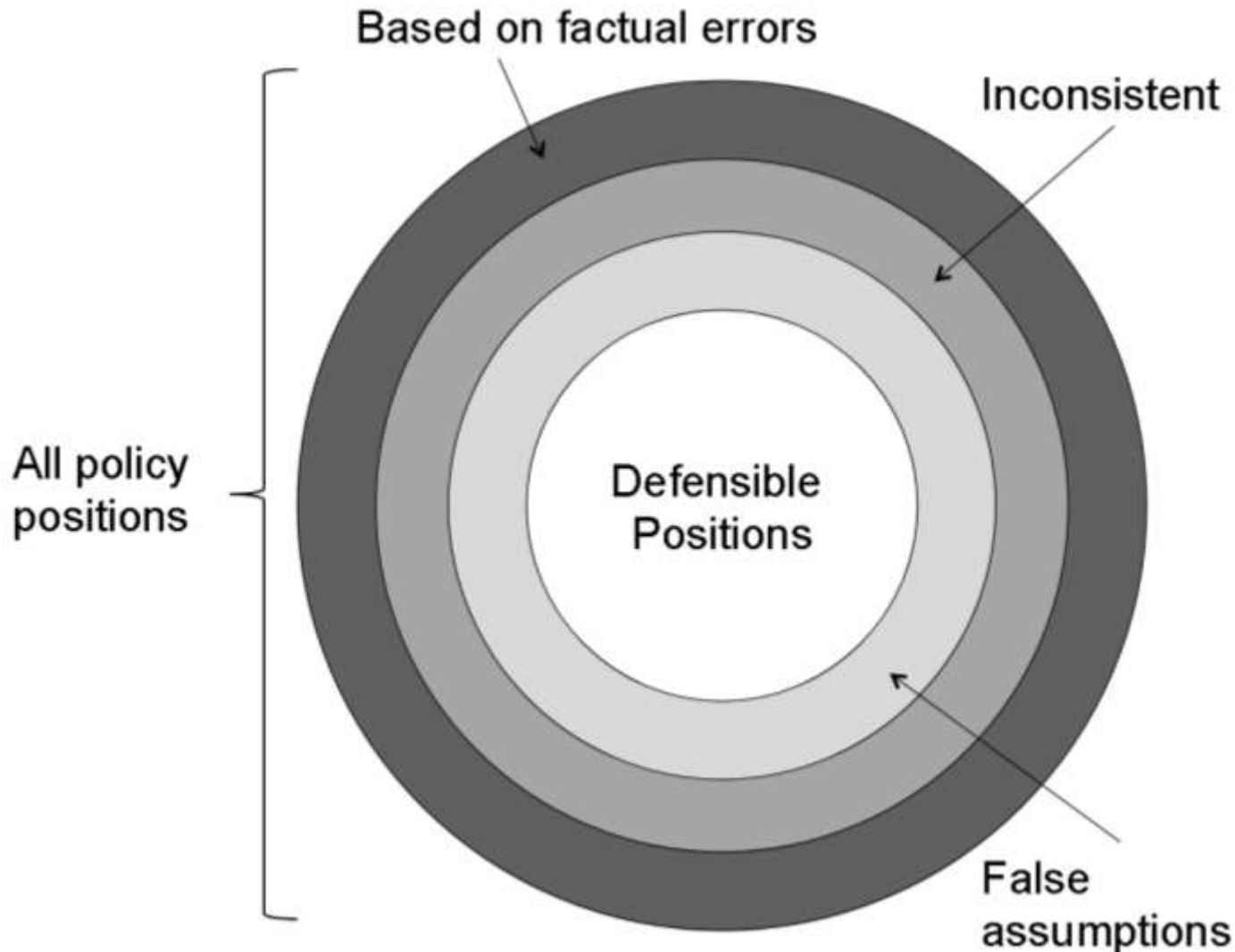
# Learning goals

- Awareness of ethical issues in software engineering
- Reflection on decision making
- Knowledge of professional codes
- Starting points to dig deeper

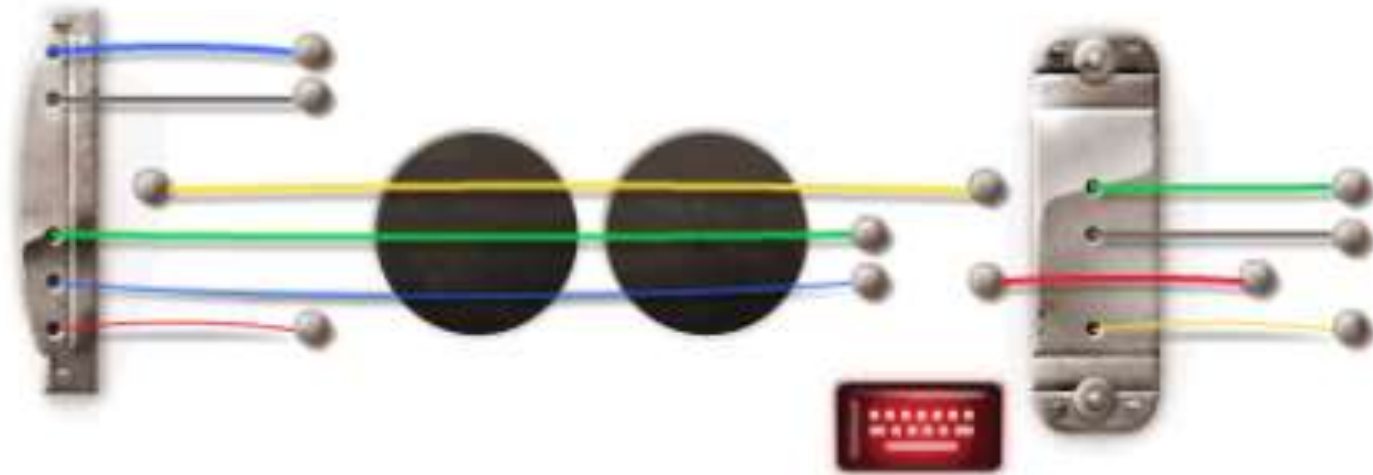
# Legal vs Moral vs Ethical

- Morality governs private, personal interactions
- Ethics governs professional interactions
- Law governs society as a whole, often dealing with interactions between total strangers
- (same for consequences)

# Different Positions Defensible



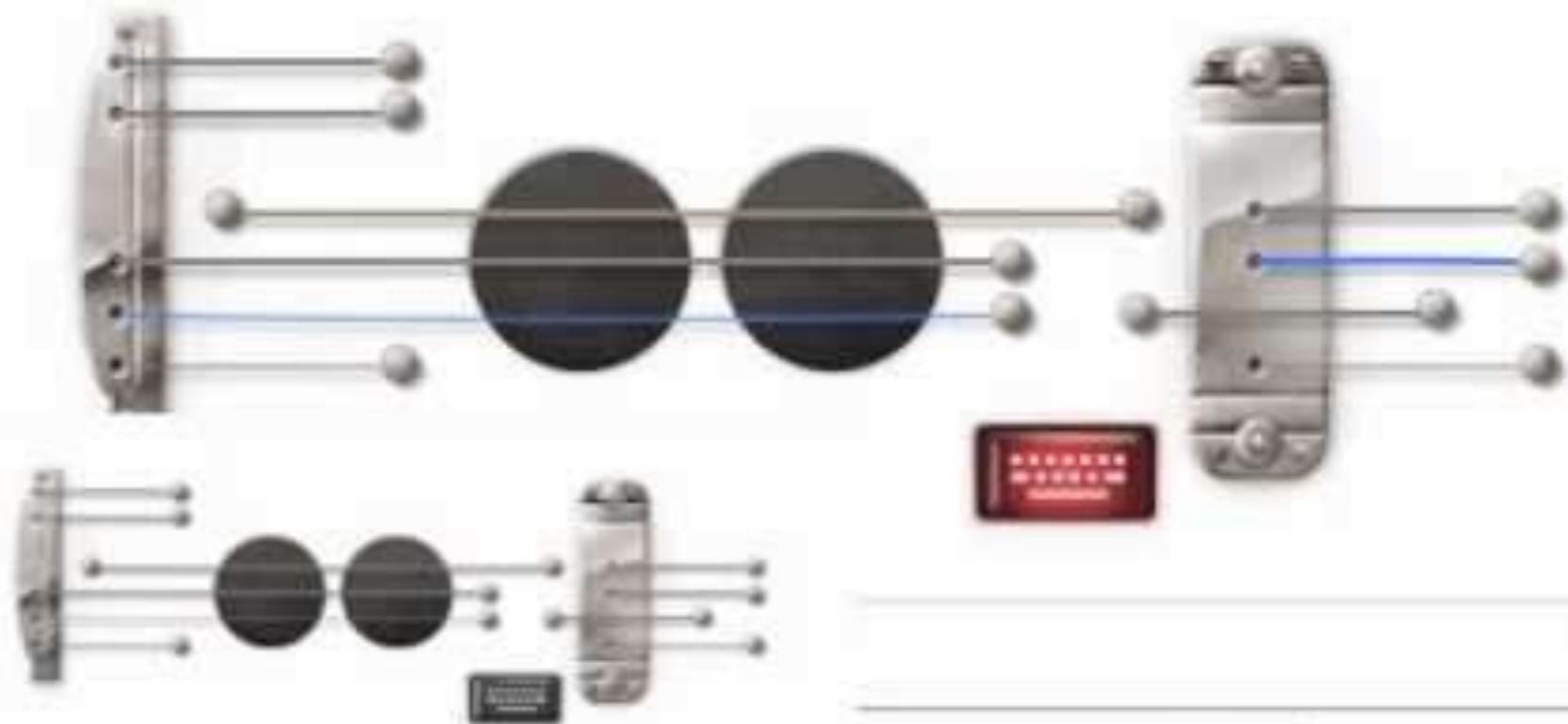
# Cases



Google Search

I'm Feeling Lucky

“Update Jun 17: Wow—in just 48 hours in the U.S., you recorded 5.1 years worth of music—40 million songs—using our doodle guitar. And those songs were played back 870,000 times!”



I've decided to do the melody as well

Pesquisa Google

Estou com sorte

Estou com sorte



# Les Paul Doodle

- Likely designed in days, side project
- Used by users for 5.3 million hours (8 lifetimes)
- Questions: Time sink, lost productivity? Negative or positive net contributions to the world? Who should consider cost/benefits? Based on what principles?

```
.  
. .  
. .  
. Welcome to Universal Paperclips  
> AutoClippers available for purchase|
```

## Paperclips: 307

### Business

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Available Funds: \$ 1.90

Unsold Inventory: 212

Price per Clip: \$ 0.12

Public Demand: 66%

Level: 1

Cost: \$ 100.00

### Manufacturing

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Clips per Second: 34

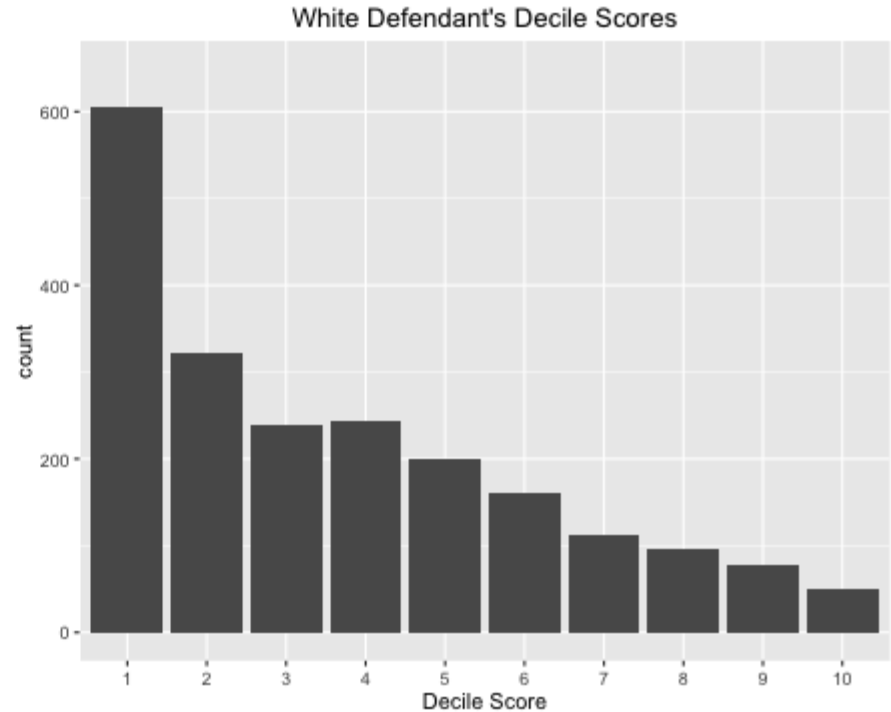
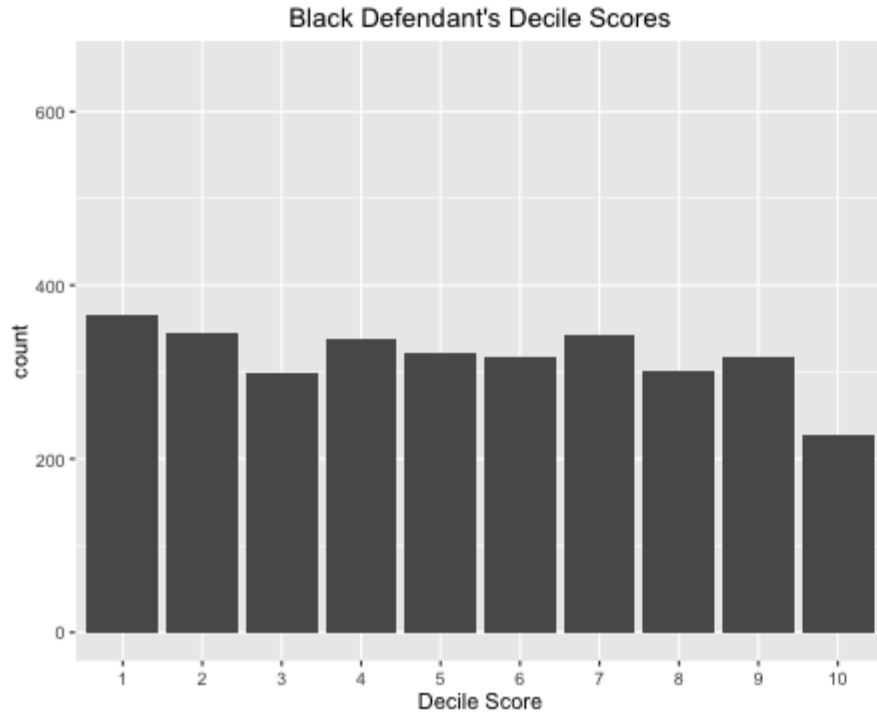
693 inches

Cost: \$ 15

2

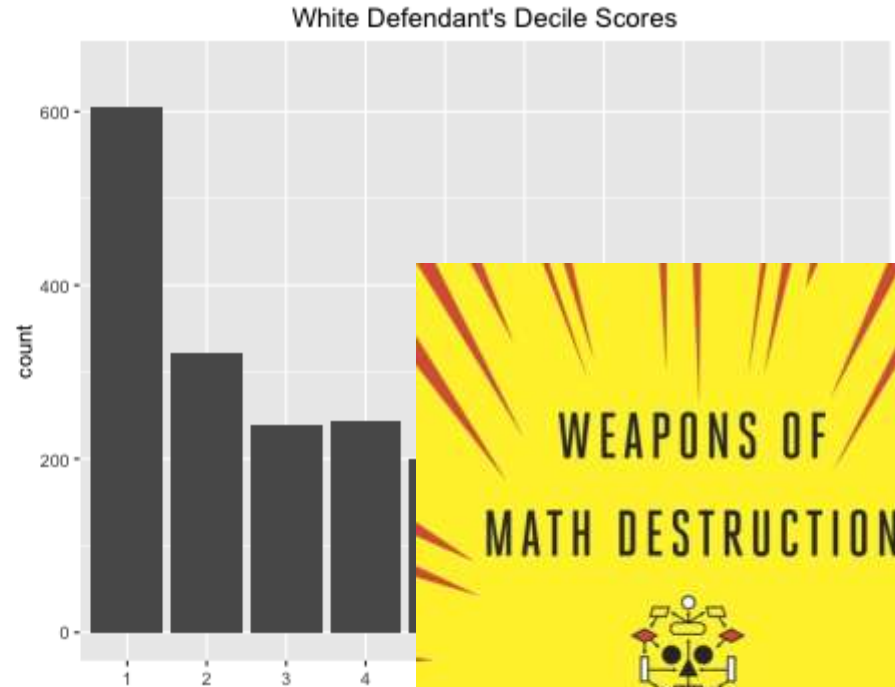
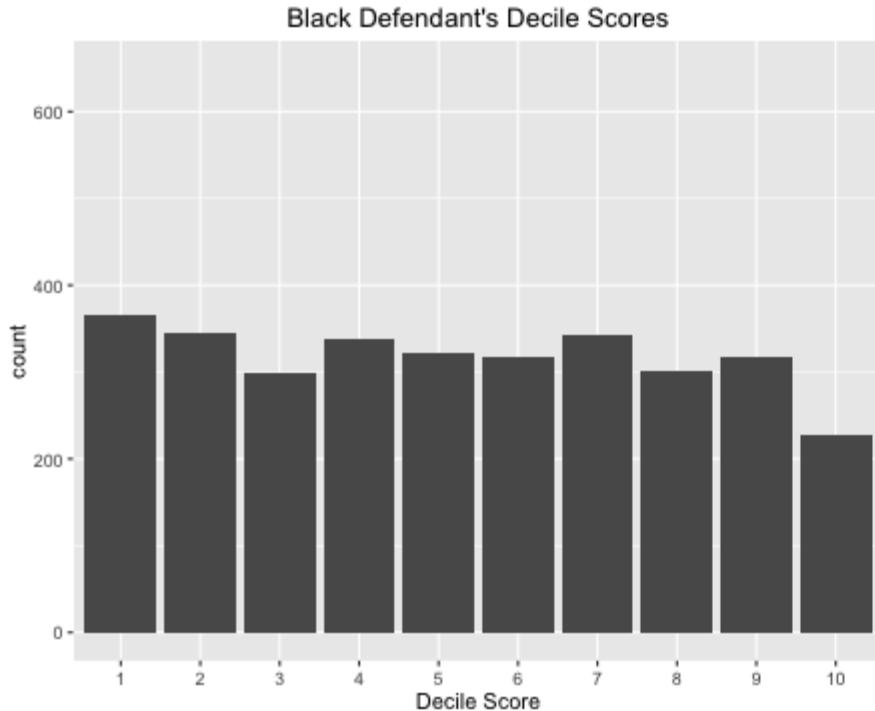
Cost: \$ 6.21

# Bias in Big Data and Machine Learning

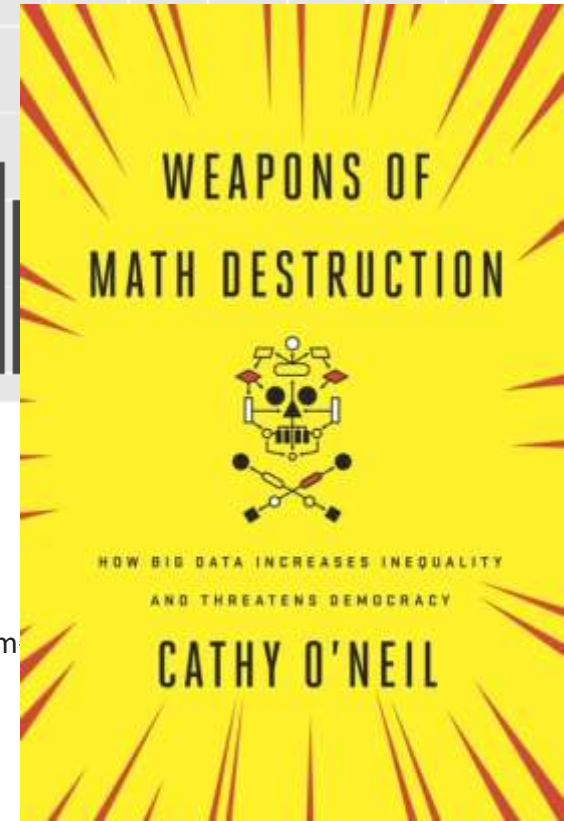


<https://www.propublica.org/article/how-we-analyzed-the-compass-recidivism-algorithm>

# Bias in Big Data and Machine Learning



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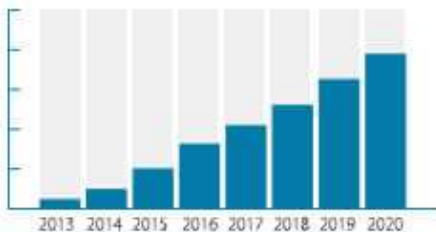


# Global Lawful Interception Market

## Size and Forecast (2013 - 2020)

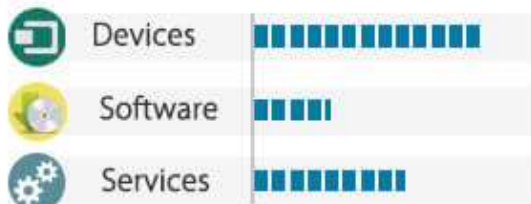
### Global Lawful Interception Market

Market is forecast to reach **\$2,100 million** by 2020



Growing at a CAGR of **20.8%** (2014-2020)

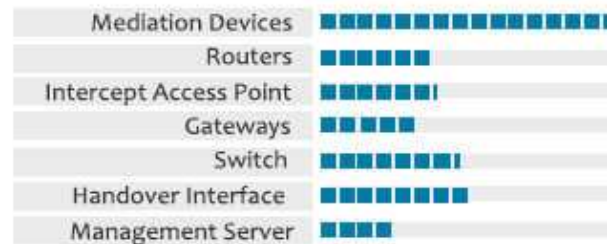
### Global Lawful Interception Market By Solutions (\$ MILLIONS) 2013-2020



■ The comprehensive view on the % share of Solutions (2013)

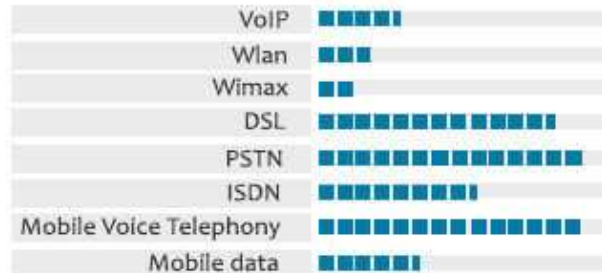
☛ For More Details See Table of Contents

### Global lawful interception market by components, (\$million), 2013-2020



■ The comprehensive view on the % share of Components (2013)

### Global lawful interception Market by Network Technology, (\$million), 2013-2020



■ The comprehensive view on the % share of Market Technology (2013)

### Global Lawful Interception Market by Geography

**Asia-Pacific**  
Fastest Growing Segment at a CAGR **15.3%** (2014-2020)



Europe, North America, LAMEA

### Global Lawful Interception Market By Dynamics

#### Drivers

- Rising criminal activities
- Dramatic increase in interception warrants
- Rising volume of data traffic and security threats
- Growing popularity of social media communications

#### Restraints

- Regulation enforcements
- Advancements in network technologies

# Dual use



# MICROSOFT SOFTWARE LICENSE TERMS: WINDOWS OPERATING SYSTEM

THE SOFTWARE ON YOUR DEVICE (INCLUDING THE APPS) IS LICENSED “AS IS.” TO THE MAXIMUM EXTENT PERMITTED BY YOUR LOCAL LAWS, YOU BEAR THE ENTIRE RISK AS TO THE SOFTWARE’S QUALITY AND PERFORMANCE. SHOULD IT PROVE DEFECTIVE, YOU ASSUME THE ENTIRE COST OF ALL SERVICING OR REPAIR. NEITHER THE DEVICE MANUFACTURER NOR MICROSOFT GIVES ANY EXPRESS WARRANTIES, GUARANTEES, OR CONDITIONS FOR THE SOFTWARE. TO THE EXTENT PERMITTED UNDER YOUR LOCAL LAWS, THE MANUFACTURER AND MICROSOFT EXCLUDE ALL IMPLIED WARRANTIES AND CONDITIONS, INCLUDING THOSE OF MERCHANTABILITY, QUALITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT.

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# One Bitcoin Transaction Now Uses as Much Energy as Your House in a Week

Bitcoin's surge in price has sent its electricity consumption soaring.

SHARE



TWEET



Christopher Malmo

Nov 1 2017, 3:20pm





# FREE SOFTWARE FOUNDATION

# Robots, Automation and the Future of Work



# Medical, Legal, Business, Engineering Ethics

# Medical, Legal, Business, Engineering Ethics

- Many fields have well-developed professional ethics
- Basic ethical duty to “hold paramount the safety, health and welfare of the public”



[http://ethics.wikia.com/  
wiki/Citicorp\\_Fiasco](http://ethics.wikia.com/wiki/Citicorp_Fiasco)

# Ethics for Software Engineers?

- Software engineers often have large autonomy (e.g. push to production)
- Fast release cycles
- Time and budget pressures

# Ethics framework



# Professional vs Personal Ethics

- “I was just following orders”
- Professionals serving the public, impact public welfare
- Ethical values/standards



# Ethical Theories

- Based on our ideas about what makes something good, valuable, right
- Provide practical guidance
- Provide a framework for analyzing issues
- A good theory should be
  - coherent
  - consistent
  - comprehensive

# Harms Software Engineers can cause?

- Is there any software engineering that's safe?

# Obligations to whom?

- Public welfare
- Some cases more obvious: QA for pacemaker
- Analyze stakeholders, including fringes



# Ethics frameworks

- Character-based/virtue ethics:
  - qualities of morally excellent persons
  - aim to develop, amend faults
- Consequentialist/utilitarian ethics:
  - derived from likely consequence of actions
  - maximizing welfare
- Deontological/rule-based/duty-based ethics
  - derived from universal rights/rules
  - human lives as source of all moral value

# Professional codes

- Codes for ethical practice
- Identify problems, guide solutions
- Judgement still necessary

# IEEE CS/ACM Software Engineering Code of Ethics (short version)

Software engineers shall commit themselves to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety and welfare of the public, software engineers shall adhere to the following Eight Principles:

- **Public:** Software engineers shall act consistently with the public interest.
- **Client and Employer:** Software engineers shall act in a manner that is in the best interests of their client and employer, consistent with the public interest.
- **Product:** Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.
- **Judgement:** Software engineers shall maintain integrity and independence in their professional judgment.
- **Management:** Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.
- **Profession:** Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.
- **Colleagues:** Software engineers shall be fair to and supportive of their colleagues.
- **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.

# Summary

- Software engineers face ethical questions regularly
- Most software can potentially cause harm
- Fast decision making under constraints
- Professional codes can guide

# Further Reading

- ACM/IEEE-CS: Software Engineering Code of Ethics  
<https://www.computer.org/web/education/code-of-ethics>
- Vallor and Narayanan. An Introduction to Software Engineering Ethics  
<https://www.scu.edu/media/ethics-center/technology-ethics/Students.pdf>
- CMU 08-200 Ethics and Policy Issues in Computing
- O'Neil. Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books, 2017.



# More cases

- Offshore development
- Experimentation and IRB
- Privacy, Data economy
- Copyright
- Streetview
- Self-driving cars
- Artificial intelligence – super intelligence
- 3d printing