Computer Science Principles

Unit 5: Impact of Computing

LECTURE 11: INTERNET IMPACTS(U10)

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Objectives

- This big idea covers all the ways society is impacted by computing devices and how we can help mitigate some of the harmful effects.

Unit Overview

Exam Weighing:
- 11-15% of the AP Exam
- Practically, this translates to about 10 questions on the test.

Vocabulary

Digital Divide

Computing Bias

Crowdsourcing

Censorship

Network Neutrality

Netizenship

Internet Engineering Task Force

Beneficial and Harmful Effects

LECTURE 1

Beneficial and Harmful Effects

- Think about the activities that make up day-to-day life: going to school, shopping, working, eating, and so on. Increasingly, computing innovations have come to play a role in more and more of these activities.

- As new innovations come out, people will change how they go about their day-to-day business to take advantage of the new technology, which will lead to new societal trends and even more new technology to take advantage of them…

Beneficial and Harmful Effects

- Computing innovations have fostered progress and creativity in many ways. Machines have vastly improved the medical field, saving countless lives. Engineers take advantage of computing innovations to collect data and design products.

- Communications have especially flourished; today, we can communicate instantaneously with people anywhere around the world. Even the artistic world has benefited from new ways to create, share, and sell creative works.
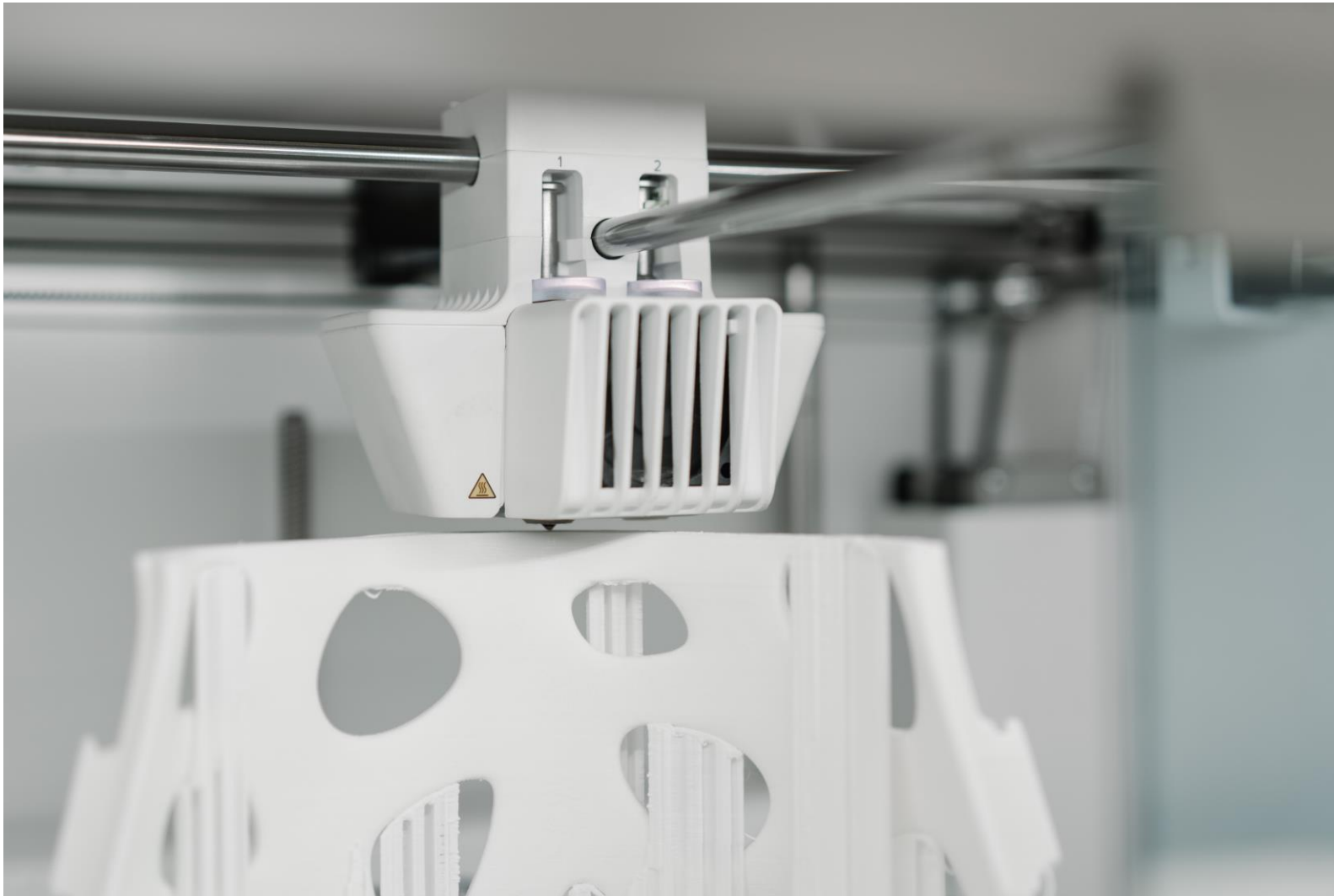
A new computing innovation with the potential to aid both the medical and engineering fields is 3D printing. In the image above, a 3D printer is used to make a hand brace.

Beneficial and Harmful Effects

- However, computing innovations have both their good sides and their not-so-good sides. (Anyone who's been scrolling Instagram at three in the morning on a school night can attest to that!)

- Not every side or effect of a computing innovation is known in advance, either.

- Innovations take on a life of their own after they're created.

Consider the following:

- The World Wide Web was invented in 1989 as a way for the scientific community to share information in a faster and easier way, and has since evolved greatly.
- Targeted advertising is intended to help businesses turn a profit, but it incentivizes the collection of private information and has the potential to be abused.
- Machine learning and data mining have greatly benefitted many fields, but their findings are also susceptible to biases and may unintentionally contribute to discrimination.

Beneficial and Harmful Effects

- Computing innovations can be used to both help and to hurt people. Identity theft, cyber-bullying... the list goes on.

- Responsible programmers try to look at the big picture when it comes to the computing innovations they create. They try to catch potential channels for abuse or harm before they can be exploited.

Beneficial and Harmful Effects

- However, although they do their best, at the end of the day it's just not possible for programmers to predict all the ways that a computing innovation could be used. There are too many possibilities and external variables involved, especially when the innovation covers a large scale. (Hence why Black Mirror exists.)

- It's important to note that the effects of a computing innovation are up for debate. People can have widely differing opinions on these effects—some people might think they're good, some people might think they're bad. It's also important to mention that there have been unintended positive effects of computing innovations as well. They've led to surprising advances in many fields.

Netizenship

LECTURE 2
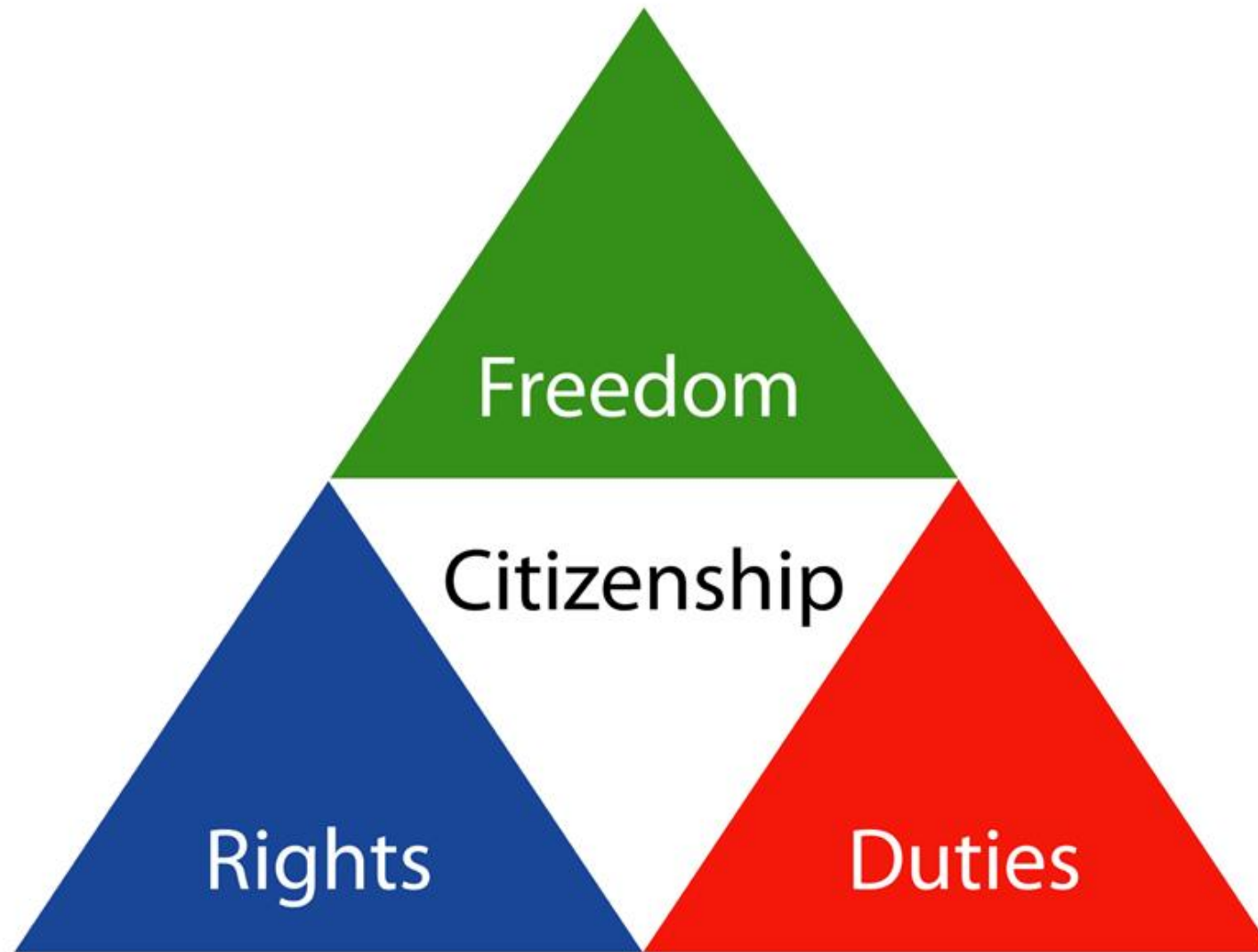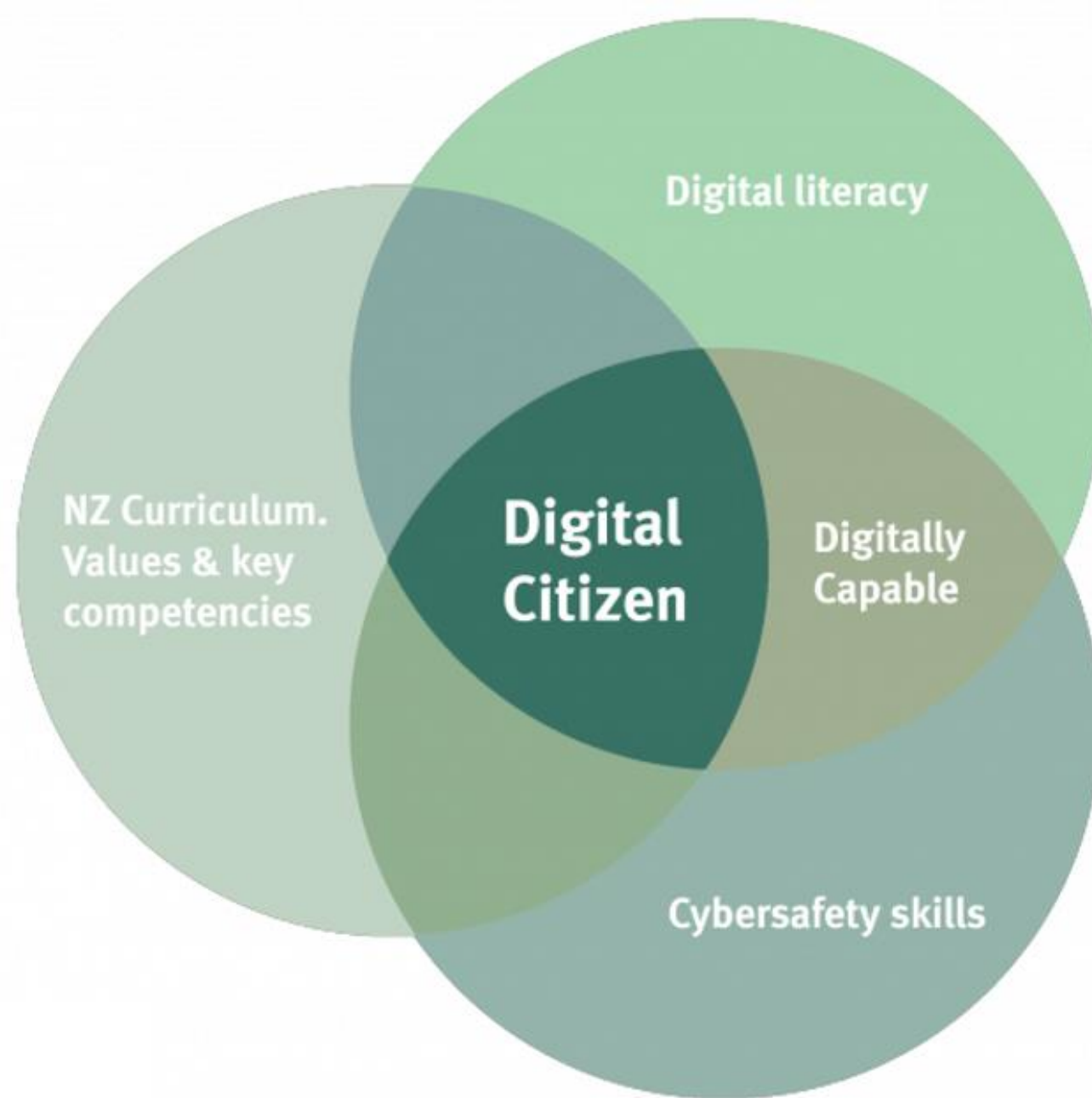
Internet Citizenship

Participate and Contribute

- It is both interesting and important to know that the protocols or rules by which Internet traffic is governed are not owned or controlled by any **government** or **business** (at the moment).

- It's a group of well-meaning **citizen-engineers** dedicated to keeping the Internet free, open and robust for all.
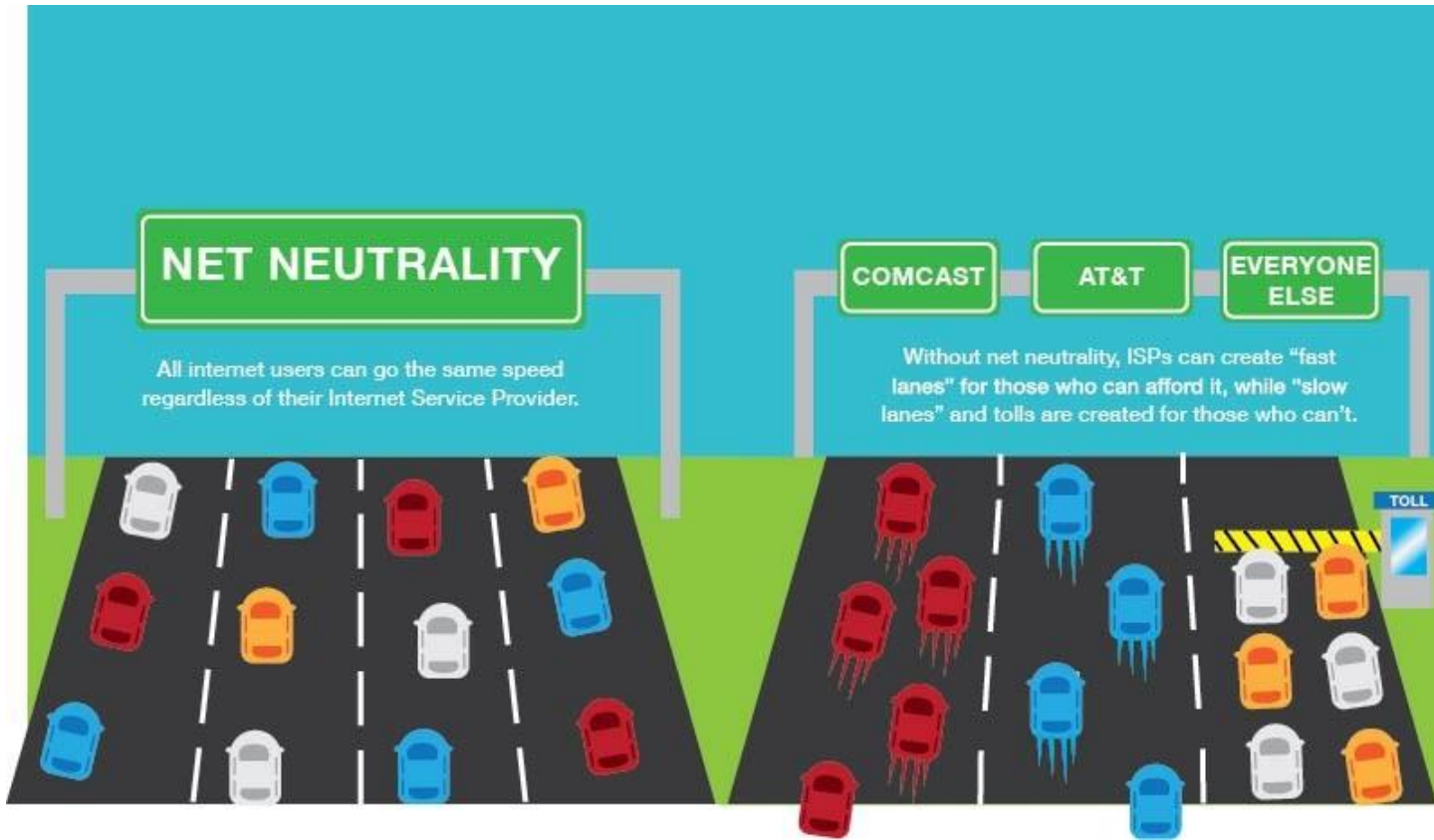
Digital literacy

NZ Curriculum. Values & key competencies

Digital Citizen

Digitally Capable

Cybersafety skills

Network Neutrality

LECTURE 3

Neutrality: Free Access

Neutrality: Equal Opportunity

The Internet Engineering Task Force

LECTURE 4

The Internet Engineering Task Force (IETF)

- The Internet Engineering Task Force (**IETF**) is the group of mostly volunteer citizens that proposes and develops all of the standards and protocols that exist on the Internet.

- Request for Comments (**RFC**) documents - like the one we use in the lesson - are how these standards and protocols are defined and published for all to see on the IETF website. They are some of the best-written technical documents in existence.
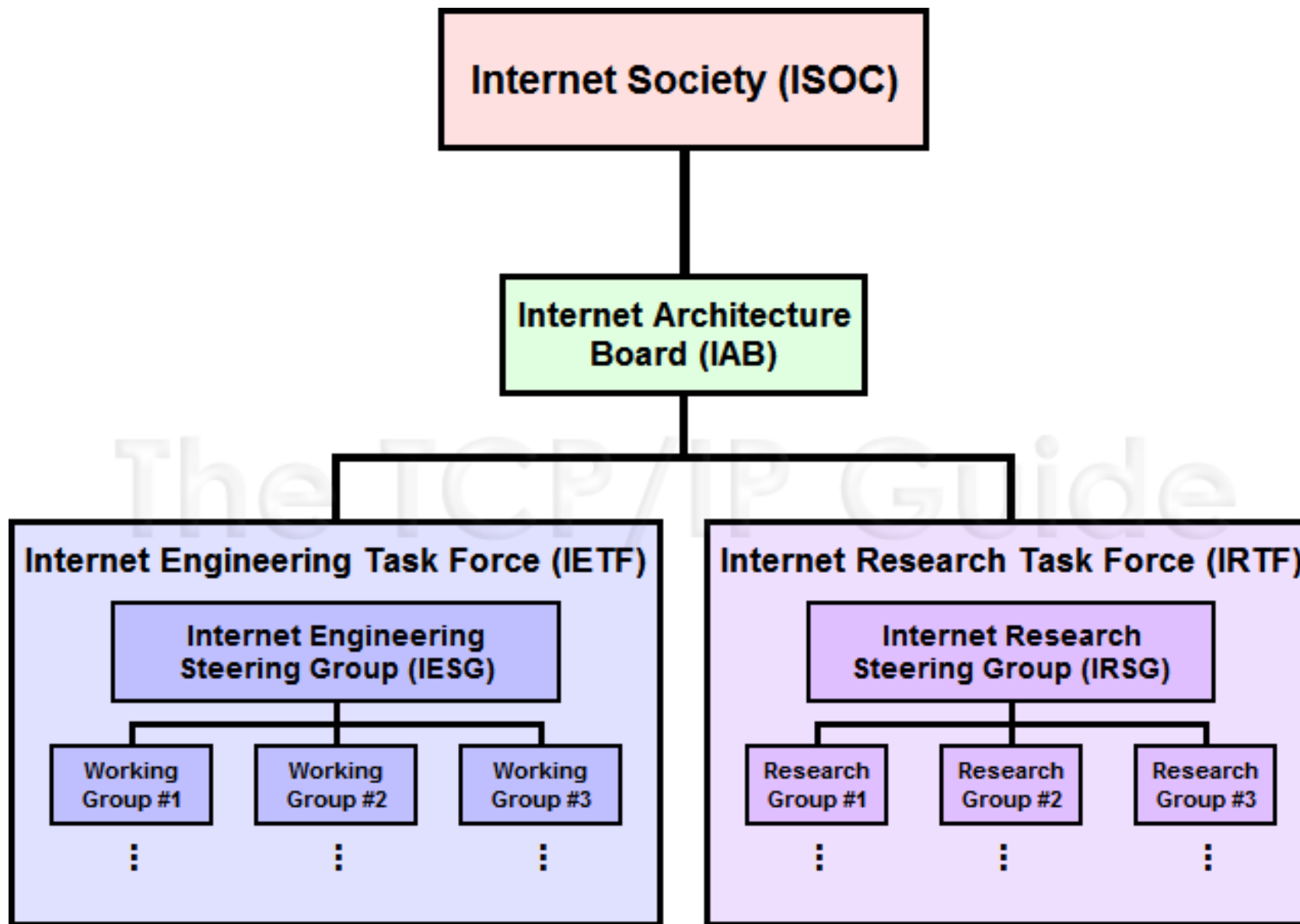
Who Developed Protocols?

- So who develops these protocols? Who makes the final decisions? Who is in charge? The amazing thing is that no single person, government, or corporation is in charge.

- The Internet is a collection of citizens and volunteers interested in defining the standards who formed a volunteer organization called the Internet Engineering Task Force to develop and promote voluntary internet standards IETF.

Internet is for Everyone

eC Learning Channel

Crowdsourcing

LECTURE 5

Crowdsourcing

- The rise of the internet has led to a rise in the amount of data and human capital available to researchers. This free flow of data and information makes identifying and solving problems easier, and more people have access to the solution once it's found. Think about all the problems you've been able to solve with a quick Google Search, where before you'd have to consult a manual or a professional.

- The spirit of collaboration the internet can foster (on a good day) extends to larger, more formal systems as well. Two examples are known as Citizen Science and Crowdsourcing.

Citizen Science

Citizen science is a term that describes scientific research that the common population helps to conduct. Ordinary citizens help contribute data to research projects using computing devices. They might, for example, count birds they see at local feeders or observe the sky to find new galaxies. Citizen science gives a wide range of people the ability to contribute to scientific studies and, in turn, provides more diverse data for scientists to work with.

Examples of Citizen Science

Name	Description	URL
Christmas Birds	Every winter, the Audubon Bird Society hosts the Christmas Bird Count, where volunteers go out and count birds. The data is then used to help measure the health of bird populations.	**https://www.audubon.org/conservation/science/christmas-bird-count**
eBird	eBird is an online database of bird information that birdwatchers help to collect. It is among one of the world's largest "biodiversity-related science projects," with more than 100 million bird sightings contributed per year.	**https://ebird.org/home**
Zooniverse	The largest platform for citizen science, Zooniverse hosts over 50 projects in a wide range of fields, from the arts to astronomy.	**https://www.zooniverse.org/**

Examples of Citizen Science

Name	Description	URL
Nasa	Nasa hosts several citizen science projects, from tracking penguin colonies to studying giant kelp forests.	https://science.nasa.gov/citizenscience
National Geographic	National Geographic also lists a wide range of citizen science projects, mainly in the fields of biology and earth science.	https://www.nationalgeographic.org/topics/citizen-science/?q=&page=1&per_page=25

Crowdsourcing

- **Crowdsourcing** is the practice of getting a large amount of input or information from people on the Internet. Citizen science is an example of crowdsourcing, but crowdsourcing can also take other forms. Companies can turn to the "crowd," or the general public, for feedback (like those College Board surveys you get in the mail). They can crowdsource for employment. Uber and Airbnb, for example, crowdsource their labor force of drivers and renters. They can also crowdsource to solve problems or to get content.

- Crowdsourcing can also take the form of financial support in a process known as **crowdfunding**. Crowdfunding sites like GoFundMe, Kickstarter, and Patreon allow people to raise money for all manner of causes, from creating works of art to (unfortunately) funding medical bills.

Computing Bias

LECTURE 6

Computing Bias

As we've discussed throughout these guides, computing innovations can reflect existing biases. **Biases** can be embedded at all levels of development, from the brainstorming phase to the work done after release. This can take the form of a bias written into the algorithm itself or bias in the data used.

Computing Bias

- For example, criminal risk assessment tools are used to determine the chances that a defendant will re-offend, or commit another crime. This information is then used to influence decisions across the judicial process.

- However, these algorithms are trained to pick out patterns and make decisions based on historical data, and historical data is historically biased against certain **races** and **classes**. As a result, risk assessment tools may disproportionally flag certain groups as risks.

Computing Bias

- Algorithms might also be trained on sets of data that aren't as diverse as they need to be. For example, facial recognition systems are often trained on data sets that contain fewer images of women and minorities than men in the majority.

- Finally, computing innovations use data from the world around them, and that world is often biased in its own right.

Computing Bias

- People can take steps to combat these biases. They can be mindful of the potential for bias and make sure that their data is as unbiased and representative as possible.

- This is not only good for the program itself, but also for society as a whole. After all, algorithms are written by people, and being able to find and eliminate bias in computers can help us eliminate bias in ourselves as well.

Digital Divide

LECTURE 7

Digital Divide

The **digital divide** refers to the gaps between those who have easy access to the internet and technology and those who don't. Internet and technology access varies across several factors:

- **Demographic** (Younger people are more likely to be comfortable with the internet than older people, people with higher levels of education tend to use the internet more than people with lower levels of education)
- **Socioeconomic** (People with higher incomes are more likely to have quality access to digital tools than people with lower incomes)
- **Geographic** (some areas allow for more internet access than others, some areas are easier to connect to the internet than others)

Digital Divide

- The digital divide is both an *intra-national* and *international* issue: it occurs both within countries and between countries. For example, countries in the Western world tend to have a larger percentage of internet users than those outside of it. However, there are also digital divides within countries.
- Take, for example, the United States, where reportedly **21 million Americans** lack access to reliable, high-speed internet.

90-100%
80-89%
70-79%
60-69%
50-59%
40-49%
30-39%
20-29%
10-19%
0-9%
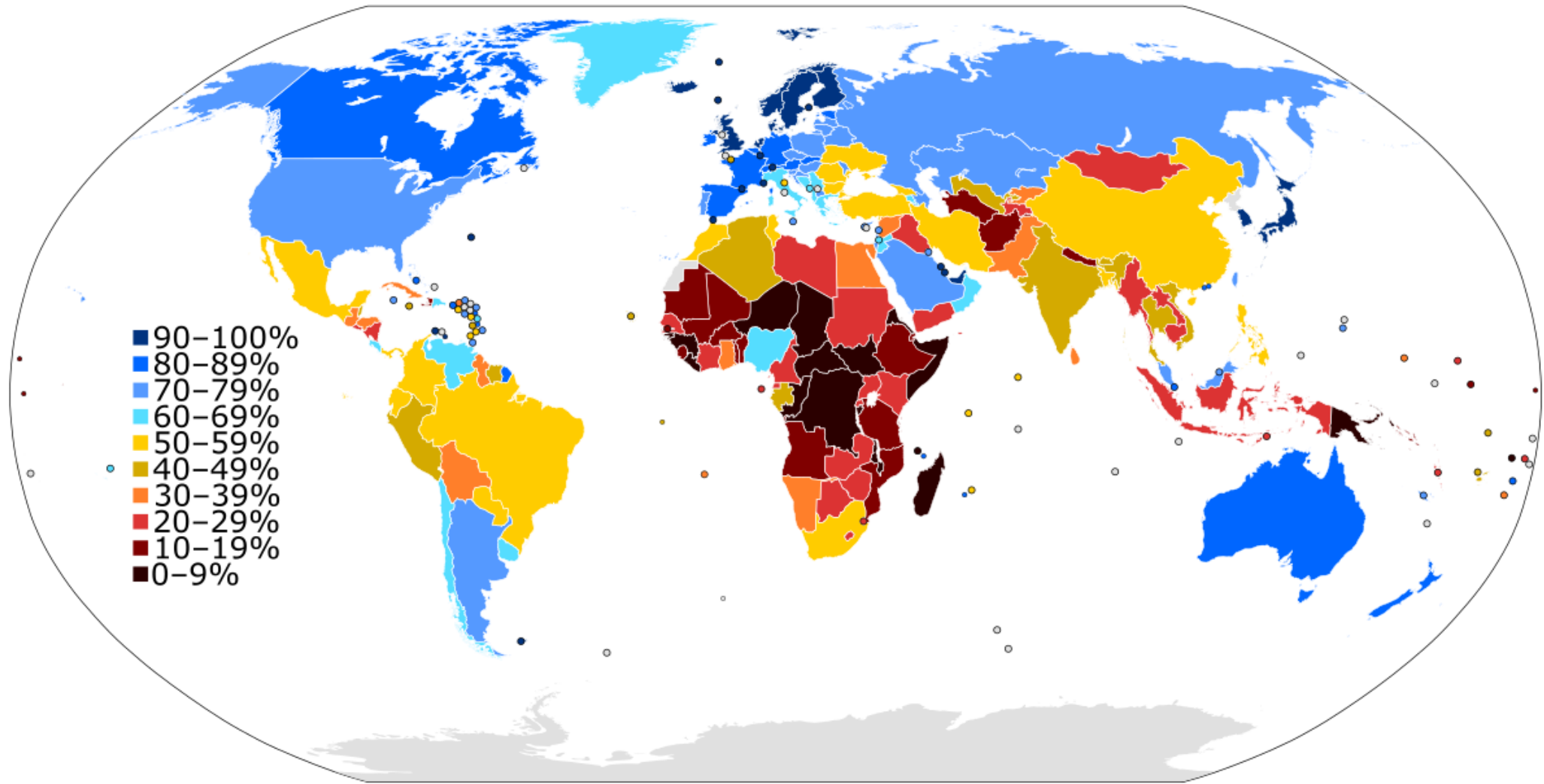
This graphic shows the number of internet users in each country as a percentage of their total population.

Digital Divide

- With the internet becoming such an important part of our lives, those without access to technology and the internet are also denied access to crucial resources. Lack of internet access leads to less efficient businesses and educational systems, for example, because those businesses can't communicate as quickly as their competitors and those students are denied access to assignments and learning resources.

- This divide can also exacerbate already present inequalities: between rich and poor, between certain races, between (well-connected) urban and (not well connected) rural communities. The digital divide reflects and raises issues of equity, access and influence, both globally and locally.

Digital Divide

- Fortunately, there are steps that people can take to help reduce the digital divide. Here are some examples!

- Schools with the funding and resources can provide devices and/or hotspots to students that need them.

- Local and national governments can fund businesses that provide internet access to areas that don't currently have access.

- Governments and individuals can also help support institutions that provide communal internet access, such as libraries.

- Websites and governments can release educational resources to help newcomers navigate the internet.

Censorship

LECTURE 8
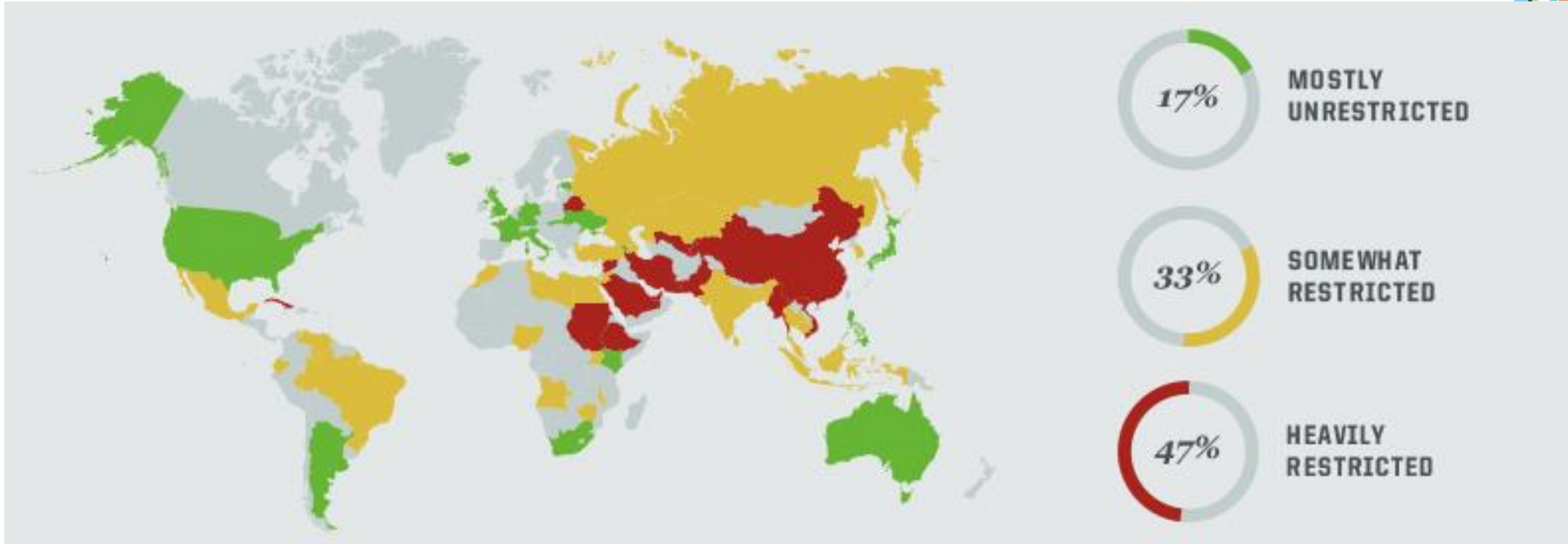
Countries which Enforces Internet Censorship

Internet Censorship

Fake News

Spying

Mind Control

Censorship