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'How Does Cyberspace Work?'
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HIGHLIGHTS

From under the ocean (or up in space) to your pocket, learn how information is transferred across the internet.

Getting online is pretty straightforward, right? Plug in a router and the rest is virtual: you enter a password, open a browser, and type in an address. But wait. Not so fast.

Hidden five miles below sea level and up to twenty-two thousand miles above the earth's surface, a large and complex network of cables and satellites allows you to find your way in a new neighborhood, stream the latest Netflix show, message your overseas grandparents, or even experience FOMO scrolling through photos on Instagram. In an age of wireless connectivity and pocket-size devices, we're ultimately dependent on a web of massive physical installations.

This infrastructure is mostly developed and maintained by private hands, and is subject to limited regulation by various groups with differing authority. We're practically all online, yet no centralized, international regulatory entity controls what happens on the internet or how cyberspace is structured and managed. And with new technology advancing about as fast as you can tweet, the landscape is only getting more complicated. Here's what you need to know about the infrastructure that supports the internet and how it is governed.

The "cloud" isn't in the sky. It's underwater.

That's right: 99 percent of all our data is transmitted via submarine cables using fiber optic technology.

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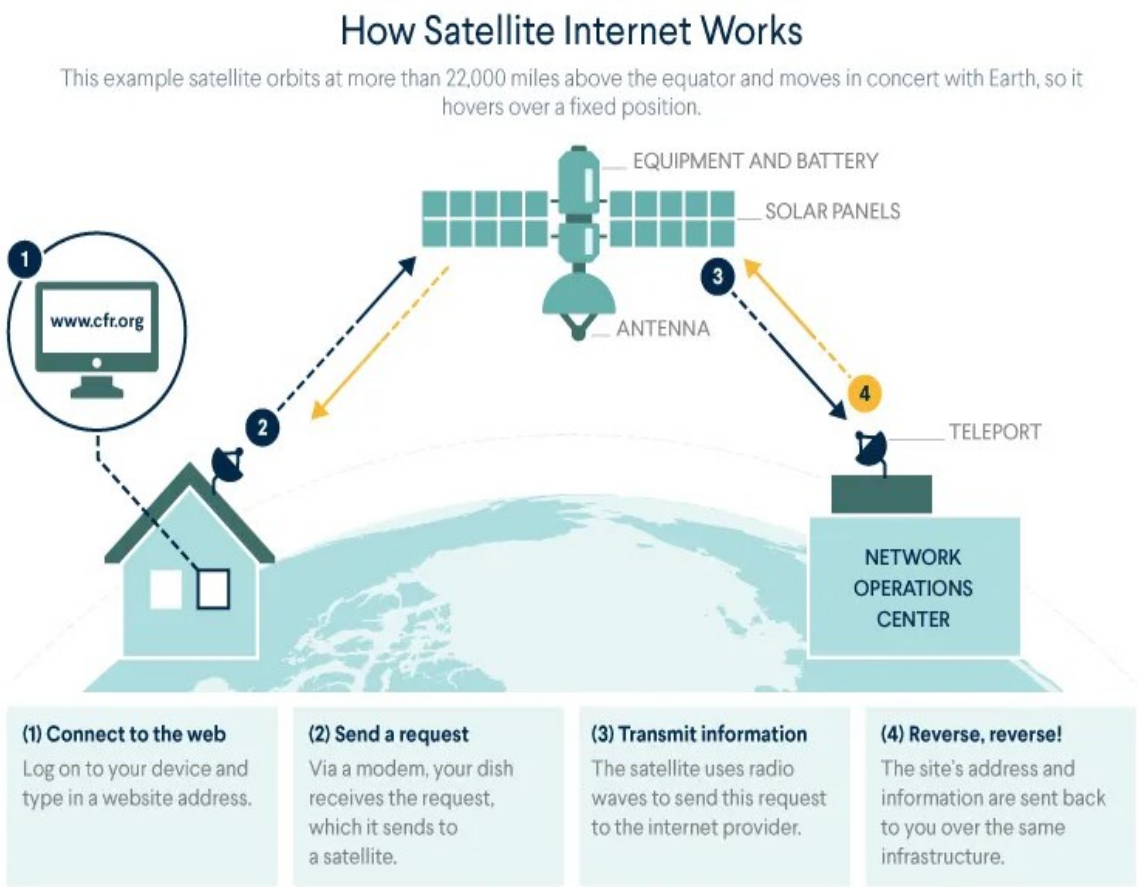
The first transatlantic fiber optics cable project was completed in 1988. Today, more than 400 cables wrap around the world, spanning a distance of nearly 750,000 miles. They collectively send and receive terabytes of data in the blink of an eye, with one modern cable boasting data speeds sixteen million times faster than your router at home.

These submarine cables are the dominant carriers of data, as they transmit lots of it quickly and relatively cheaply. (On land, underground cables, usually laid adjacent to highways and railroads, continue the work.) But they don't work alone.

As you read this, thousands of satellites are orbiting the earth.



As fiber optic technology has improved, satellites have fallen out of favor, because they're more expensive and several times slower than cables .However, they're not obsolete. Global Positioning System (GPS) relies on satellites, which also monitor weather and enable radio and television communications. Satellites are particularly useful for least developed countries that lack fiber optics capacity, and they can also facilitate

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cable traffic. For example, a video captured by a military drone is first transmitted to a satellite, which then sends it to a cable that delivers the footage to the operator's computer.

Private companies own most of this infrastructure.

The internet connects billions of people doing nearly as many things. Because connectivity is basically as essential to modern life as electricity or running water, the internet is sometimes talked about as a public utility. The reality, however, is that its basic infrastructure is almost entirely privatized.

As of April 2020, there were fewer than three thousand operational satellites in space, and the majority of those in orbit today operate commercially. For example, in 2018, the Federal Communications Commission granted SpaceX permission to send more than four thousand satellites into orbit.

Because private companies own this infrastructure, they're in charge of its upkeep. When a ship's anchor or a natural disaster breaks a cable (shark bites and intentional sabotage are rarely to blame), these companies get to work funding and performing repairs.

But governments do intervene in a few areas.

Countries grant licenses to companies that install cables, and, depending on the government, take steps to regulate, monitor, and set standards for all kinds of cyber infrastructure. For example, New Zealand passed legislation in 1996 to protect cables and pipelines, in part by regulating fishing and anchoring activity, as well as establishing a cable protection zone. In 2018, the European Union enacted the General Data Protection Regulation (GDPR), which—among many other provisions—limits what companies can do with personal data stored in data centers: the big, energy-guzzling buildings where networks converge and exchange information.

Two main international agreements govern cyber infrastructure.

For satellites, there's the 1967 Outer Space Treaty. Drafted at the height of the Cold War, with the space race at full throttle, the treaty doesn't specifically lay out guidelines for satellites, but it holds that outer space belongs to all, should be free of weapons of mass destruction, and must be used for peaceful purposes.

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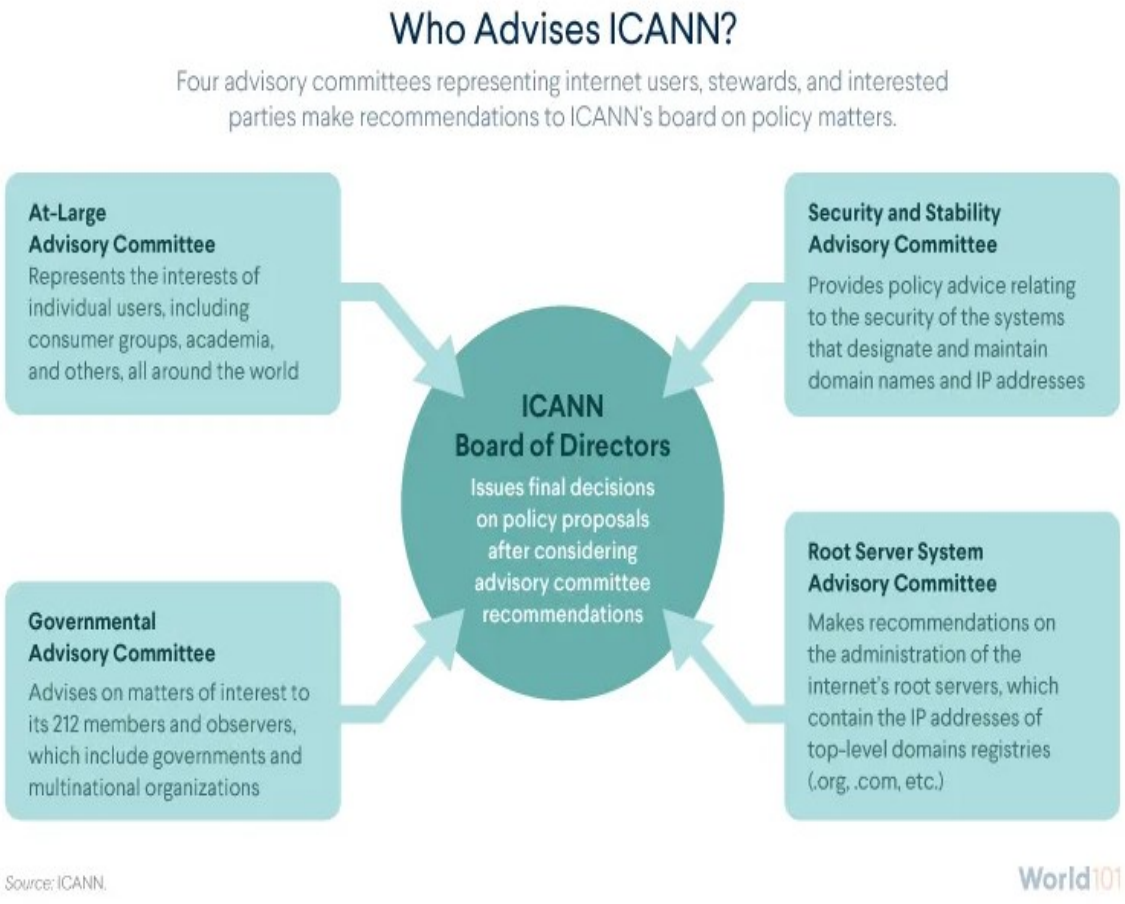
For submarine cables, the 1982 UN Convention on the Law of the Sea (UNCLOS) applies. Under UNCLOS, any country has the right to lay cables in international waters. Even within a country's territorial waters, which extend up to twelve nautical miles from shore and constitute sovereign territory, the country can't forbid the installation of cables but can take steps to regulate them.

There are also a few standards-setting organizations, but their reach is limited and not legally binding.

The most notable is the Internet Corporation for the Assignment of Names and Numbers (ICANN). A nonprofit established in 1998 and originally tied to the U.S. Department of Commerce, ICANN has operated independently since late 2016. ICANN provides internet protocol (IP) addresses and gives domain names to those addresses (e.g., you typed a domain name, world101.cfr.org, to get here, rather than the site's IP address, which is a series of numbers).



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This patchwork of rules, responsibilities, and regulations is the legacy of the internet's niche origins.

Remember, the first people to be "online" were a handful of military personnel, scientists, and engineers who used the internet to share information. That's a far cry from the 3.9 billion people who hop online to live tweet, watch TV, and buy millions of different products.

This means that the rules, when they exist, are often retroactively applied or outmoded. Look at UNCLOS, for example: although it was drafted several years prior to the installation of the first submarine fiber optics cable, it remains the main international agreement pertaining to the submarine cables.

As the number of internet users—and uses—multiplies, so do the regulatory challenges.

Cyberspace is already vast, and it's getting even bigger. As we live more of our lives online, we should at least have the infrastructure to do so efficiently and securely.

However, with so many relatively slow-moving actors—nongovernmental organizations, national governments, private companies, and international bodies—involved in managing and governing a technology that changes rapidly, it's less certain that regulation will keep pace with technological advances. We'll have to continue determining the rules of the road (and the ocean and outer space) while barreling forward.

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By 2022, NLP trends and predictions will enhance the tech-driven industry

Natural language processing (NLP) is one of the hottest fields in artificial intelligence (AI) and machine learning (ML) right now. The global NLP industry is expected to reach US$42.04 billion by 2026, with a CAGR of 21.5%, according to Mordor Intelligence. This rapid expansion of NLP has resulted in the emergence of new trends and advancements in the field. Let's take a look at some NLP trends to look out for in 2022.

Transfer Learning

Transfer learning is a machine learning approach that involves training a model for one job and then repurposing it for a related activity. Instead of developing and training a model from start, which is costly, time-consuming, and requires a large quantity of data, you may simply fine-tune one that has already been trained. As a result, organizations can accomplish NLP jobs faster and with less labeled data. Transfer learning, which first gained popularity in the field of computer vision, is now being utilized in NLP applications such as intent classification, sentiment analysis, and named entity recognition.

Fake News and Cyberbullying Detection

NLP has become a critical tool for detecting and preventing the spread of fake news and disinformation, saving time and effort. We've already seen several intriguing methods to automatic fake news identification this year, and we'll likely see more of it in 2022, with so much incorrect information about Covid-19 circulating. Cyberbullying detection is another method NLP is being utilized to make a good influence. On social media, classifiers are being developed to detect the usage of abusive and derogatory language, as well as hate speech.

Monitoring Social Media Using NLP

In 2022, sentiment analysis, also known as opinion mining, will continue to play a significant role, allowing businesses to monitor social media and gain real-time insights into how customers feel about their brand or products. Using natural language processing (NLP) tools to assess brand sentiment can assist businesses in identifying areas for improvement, detecting negative comments on the fly (and responding proactively), and gaining a competitive advantage. Analysis of the impact of marketing efforts and evaluating how consumers react to events such as a new product introduction are two more intriguing use cases for sentiment analysis in social media monitoring.

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Reinforcement Learning Training Models

Reinforcement learning is a machine learning subfield that is expected to expand in 2021. Reinforcement algorithms, in essence, learn by doing, using a trial-and-error process that incorporates input from past acts and experiences. Reinforcement learning may be used in natural language processing to speed up tasks such as question answering, machine translation, and summarization. Currently, supervised algorithms are used to train NLP models, which are subsequently fine-tuned via reinforcement learning.

The Use of Multilingual NLP Will Increase

Too far, the majority of NLP advancements have been concentrated on English. Companies like Google and Facebook, on the other hand, are increasingly releasing pretrained multilingual models that perform as well as or better than monolingual models. Open-source libraries are following in the footsteps of Google and Facebook, with recent improvements in language-agnostic sentence embeddings, zero-shot learning, and the availability of multilingual embeddings, thus we may anticipate seeing an increasing trend in multilingual NLP models in the coming year, 2022.

Using a Mix of Supervised and Unsupervised Machine Learning Techniques

Combining supervised and unsupervised approaches for developing a model for NLP appears to produce more accurate results. Supervised learning, which is often used for tasks like topic categorization, necessitates a significant quantity of labeled data as well as several iterations before a model can generate good predictions. There is no labeled data in unsupervised learning: the model learns from input data and can recognize patterns and draw conclusions on unseen data on its own. Clustering is an example of this, in which related items are clustered together. Combining supervised and unsupervised learning has been proven to improve the performance of machine learning models, particularly for text interpretation.

Automating Customer Service: Tagging Tickets & New Era of Chatbots

Integrating natural language processing technologies with help desk software, for example, might automate time-consuming and laborious operations like labeling and routing customer support issues, freeing employees to focus on higher-value work.

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On the front lines of customer service, chatbots will continue to play an important role. Despite certain restrictions, they can typically have a basic conversation and do activities for which they have been trained. With advances in natural language processing (NLP) and rising customer service demand, we can expect to see significant progress toward the next generation of chatbots, which will be able to self-improve, hold more complex conversations, and possibly learn how to complete new tasks without prior training.

The Rise of Low-Code Tools

Back in the day, developing NLP models needed an extensive understanding of AI and machine learning, coding, open-source libraries, and other topics. No longer, thanks to low-code technologies that make life easier. While low-code or no-code tools have existed for some time, their use has been restricted to web and software development. We may see the emergence of these technologies in the NLP area as well in 2022. MonkeyLearn, a SaaS company, aims to democratize machine learning and natural language processing by making them accessible to non-technical people. The company has created a model builder that allows you to create, train, and integrate emotional analysis and text classification models using a point-and-click interface.

NLP will Necessitate a Comprehensive Strategy

From a commercial standpoint, organizations that understand how AI will operate within a product, in addition to the technical skills required to launch and grow an NLP project, will do better. To remain competitive, all departments of an organization must comprehend the benefits of AI integration and how it will impact their roles. Many initiatives fail because of a lack of holistic AI integration, in which product managers, designers, marketing, salespeople, and others aren't actively involved in its adoption. In the coming year, 2022, the overall investment in knowledge, time, energy, and practice throughout the whole organization will determine its success.

Transformers Will Lead the Way: BERT & ELMO

BERT (Bidirectional Encoder Representations from Transformers) and ELMo (Embeddings from Language Models) will be the focus of the NLP community in 2022. These models have been trained on massive quantities of data and can enhance the performance of a wide range of NLP issues dramatically.

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