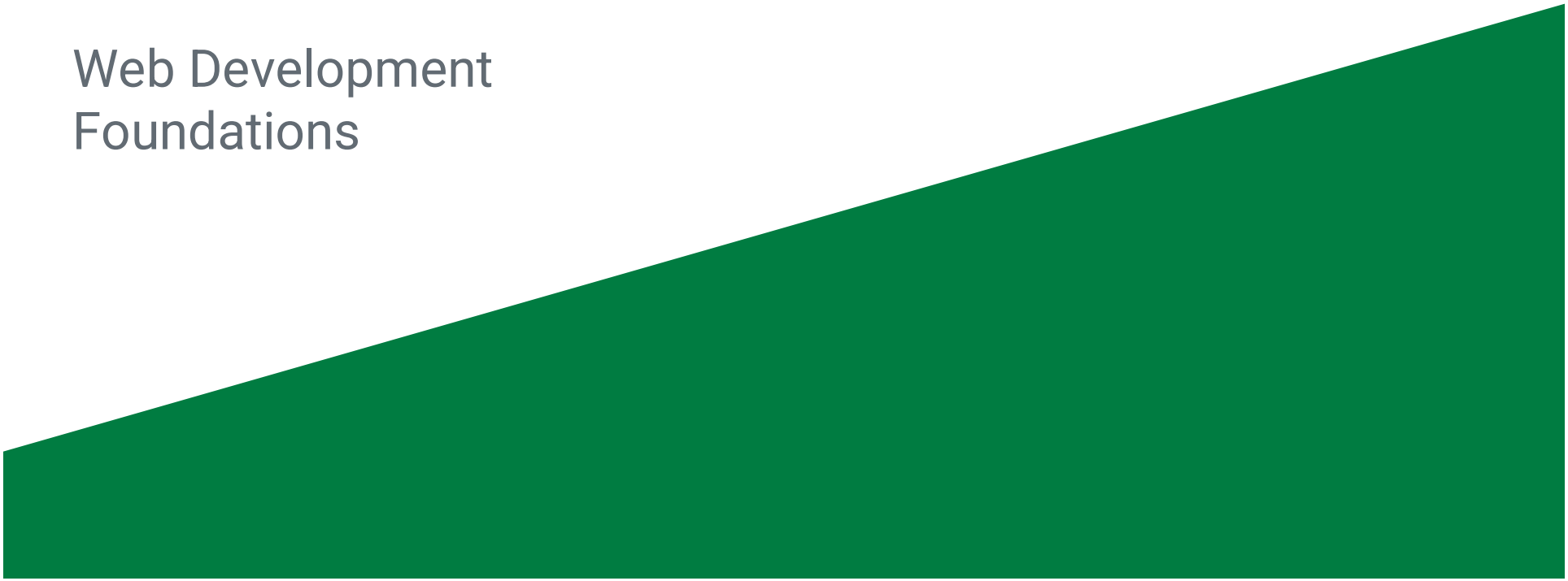
Domains and DNS

Web Development
Foundations



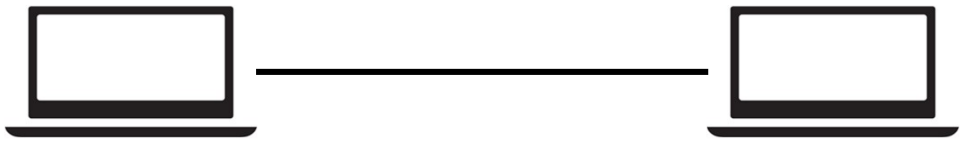
Network Basics

Why Connect Devices?

We can get a lot of utility and use from using a single device on its own. Perhaps you need to write a Microsoft Word document—you can definitely write one on your personal computer and save it to its hard drive. How might you share this with a friend or coworker though? Perhaps you save a copy to a USB flash drive, and hand it over to your friend to access on their own computer.

Connecting devices like computers—capable of communicating—makes the process of sharing files or data easier. It also makes sharing over longer distances faster and more convenient than walking over with a thumb drive or physically mailing one to someone you know.

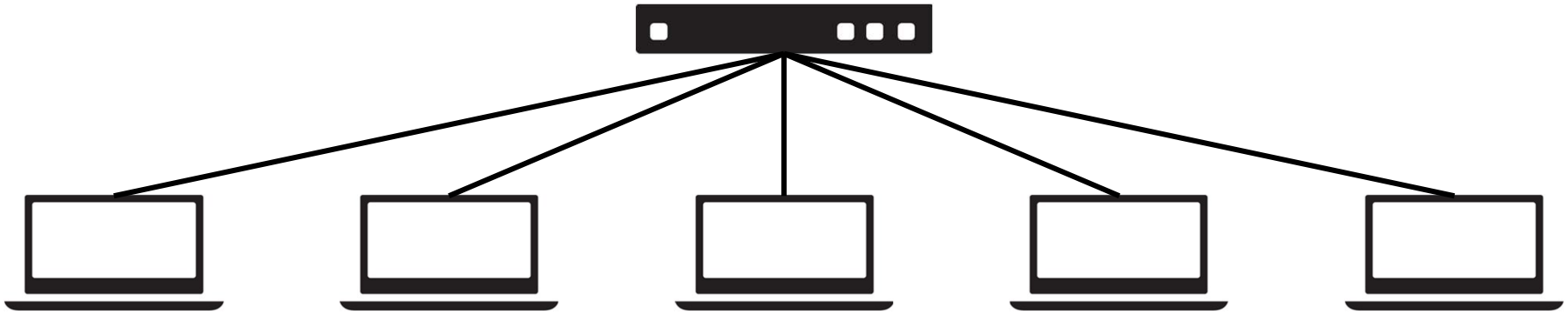
One of the simplest ways to connect two computers would be an ethernet cable—many modern devices also allow wireless device-to-device communication via wi-fi or bluetooth.



Local Area Network

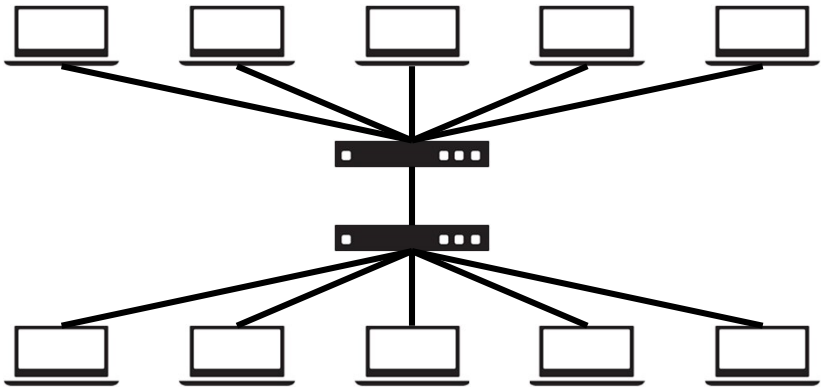
Within a household or in an office building, a local area network (LAN) may be utilized. This is a localized connection for a set number of computers within a small geographical area. Such a setup often takes advantage of a router to act as a more central point for many computers to connect to each other through.

Think of it as a traffic director!



Scaling Up

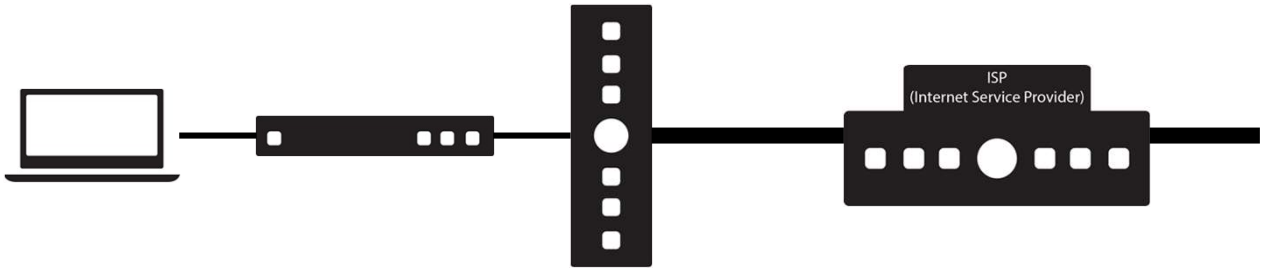
We can connect networks like this together by connecting routers to other routers, and so-on. In setups like this, each computer, provided the configuration is open and correct, would be able to communicate with any other in the network. This really opens up doors to how big a network can end up being in larger organizations, but it doesn't quite get us to the global level of the internet.



Connecting to the Outside World

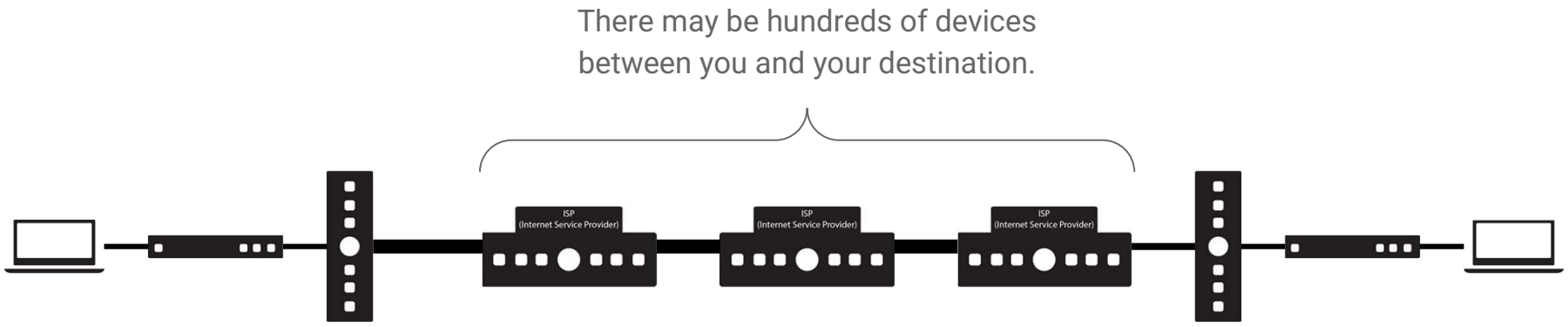
To connect to computers outside of your local network, typically we take advantage of more global infrastructure like cable or telephone lines. These may not necessarily transfer a digital signal, though, so we require a modem to translate data to and from more analog formats.

With both a modem and router, your local computers are able to communicate to your ISP's (internet service provider's) modem(s) and routers.



The Internet

Once a request has gotten to an ISP, they are able to forward it to other ISP modems and routers, getting your request closer and closer to your target destination. Ultimately, if you have the correct address, your request will get to the computer you were hoping to reach, and it can send information back to you in the form of a response.



IP Addresses

Computer Addresses

In the last slide, we mentioned an address that can be used to help identify which computer you are hoping to connect with. These are referred to as Internet Protocol addresses—or IP addresses for short.

There are two formats typically used in both local networks and the internet for such identification. IPv4, which is a shorter number, or IPv6 which is a newer longer number. As time has gone on, more and more devices require an address online, so we have seen an increase in the need for more unique addresses. This has resulted in a higher adoption rate and necessity for use of IPv6 addresses in recent years.

Example IPv4 address) 172.16.254.1

Example IPv6 address) 2001:db8:0:1234:0:567:8:1

IP Addresses and the Web

It is important to note that a “web server” is just a computer with specialized software for delivering web pages if it receives a request from a web browser.

If you want to view a website, you may open a web browser, and type into your address bar. What you submit, your computer or device will submit to the router, the modem, and ultimately through a network of ISPs, until it is able to connect to the target computer and ask for a web page file.

As an example, open your preferred web browser and type into the address bar:

http://142.250.65.78

At the time of writing, this will deliver you to…

https://google.com

Why Does that Work?

Notice that as humans, it can be difficult to remember numerical addresses like Google's IP: 142.250.65.78

Because of this, there was demand for a system where we could use simpler names to represent IP addresses. With simpler and easier-to-remember names, we'd have a much easier time connecting to desired computers and downloading the correct web page files.

Enter: domain names. These are an alternative to typing out the entire IP address. Let's break down that process...

Domains

Domain Name System (DNS)

DNS as a system and service acts as a digital “phonebook.” When a device needs to access a specific host, it will communicate with a Domain Name Server. A DNS Server, or Domain Name Server, holds records for many different IP addresses and their corresponding domain names within a colossal database (or sets thereof.)

This is important, as over time the IP a domain represents may end up requiring a change. Any given website may end up moving to different servers throughout its life, and it is important that these public records be kept up-to-date, or you might not be able to access your favourite websites. Worse yet, you might have otherwise lost access to important sites like personal banking or government service websites.

To simplify the idea, a rough representation of what is stored in a domain name server could look like:

Domain Name	IP Address
google.com	142.250.65.78

Domain Registrars

Domain names can be registered via one of a great many businesses or organizations around the world.

A "domain name registrar" is any company or organization that offers as a service the reservation or purchase of domain names. This would include key players in domain and hosting sales like: GoDaddy, Bluehost, DreamHost, HostGator, Google, OVH, Web Hosting Canada, and many more. Each of these companies have a website you can visit, search available domains, and ultimately reserve your own (provided it is not already taken by another individual or organization.)

Note that different top level domains may have a different average cost associated with them. For instance, a ".COM" is often priced around ~$20 per year to reserve, while a ".CODES" might be closer to ~$40 per year. It is important to realize that, barring some special offers, the price of the domain name is in addition to hosting costs.

Have a look around to see which top level domains exist out there for you to choose from.

Anatomy of a Domain

subdomain.domainname.topleveldomain

Let’s go over each part that makes up a standard domain that you’ll come across on the web:

- Top Level Domain (TLD)
- Domain Name
- Subdomain (Optional)

Top Level Domain (TLD)

subdomain.domainname.topleveldomain

A top level domain will appear at the “end” of the full domain name. You are likely most familiar with TLDs like “.COM” and “.CA”. Note that these are intended to be descriptive for the website, if you have search engine optimization (SEO) and visitors in-mind. As an example, “.COM” stands for “commercial.” It is intended for a standard business or commercial website. “.CA”, in contrast, intends to represent specifically Canadian individuals, organizations, and businesses.

Before deciding on a domain name, have a look for the most sensible and descriptive TLD you can find for your purpose. There are plenty of new and emerging TLDs that add a lot of flexibility and many more options to your approach. An aspiring photographer may opt for a “.PHOTOGRAPHY” TLD, for instance. It immediately communicates to their customers and any search engines what the purpose of the website and/or business is before they even visit the website.

Domain Name

subdomain.domainname.topleveldomain

Top level domains help us describe our website, but there can be millions of websites that share a top level domain. Consider how many websites you've visited that end in ".COM". For domain names to make sense in pointing to unique devices and servers, we need to ensure part of each full domain has some component that is unique to each individual or business that has registered a domain.

The part that you are choosing when you are reserving a domain, is the "domain name". This would be the "GOOGLE" in "GOOGLE.COM". The TLD (".COM") describes that this is a page from a commercial entity, and the domain ("GOOGLE") tells us which one.

Sub Domain

subdomain.domainname.topleveldomain

If the “domain name” covers both a managed TLD and the unique part of the name, is there any more control afforded to us? Absolutely. Let’s have a look at a domain name like… “MAPS.GOOGLE.COM”. Note there are three components to this one. “MAPS” is referred to a “subdomain.” Subdomains allow us to point at other servers and devices than our main domain would (though it is possible to point them to the same server if you’d like.)

In terms of how visitors and search engines view subdomains, note how descriptive this becomes:

- “.COM” suggests the webpage is from a commercial entity.
- “GOOGLE” tells us who that entity is, or what the website topic is.
- “MAPS” tells us further about what this part of the entity or topic is.

This is very specific and lends itself well to telling visitors a lot at a glance. Note, however, that the main domain and any subdomains all rank as completely separate websites on most, if not all, major search engines. It is important to implement SEO strategies carefully and with this in mind.

Zone Files and Domain Name Records

You may ask yourself: “How does one configure a domain once it’s reserved?” Most domain registrars offer a “zone file” or a control panel for updating domain records. Once you’ve submitted your changes to the registrar, they ensure that DNS servers are notified of the updates so that they can begin updating the public records. Each domain may have one or more types of records set up for it. Some of the most common are: A Records, CNAME Records, MX Records, and TXT Records (though you may see more when out in the wild!)

Note that a domain may have *multiple* of each type of record, depending on their type.

Some Common Record Types

A Record

An “A Record” or, “Address Record” points to a specific IP address. For websites, this is usually always in place to point visitors to the correct web server. Additional A Records are often added for use of subdomains.

CNAME Record

A “CNAME Record” or, “Canonical Name Record” acts as an alias to another domain. Devices looking up based on a CNAME, look at the domain entered into this record instead of pointing directly to a server itself. They can be applied to the main domain name and/or subdomains.

MX Record

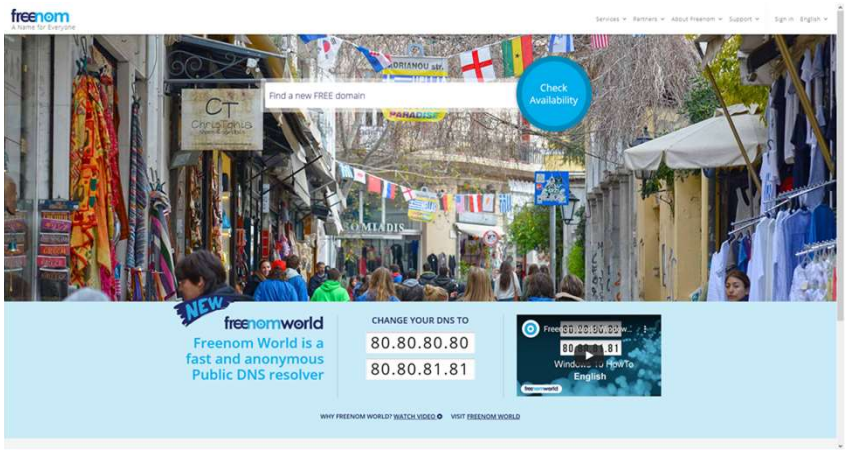
An “MX Record,” or, “Mail Exchange Record” is used to map a domain to mail servers and / or “message transfer agents.” These are used for sending and receiving e-mails properly through your domain.

TXT Record

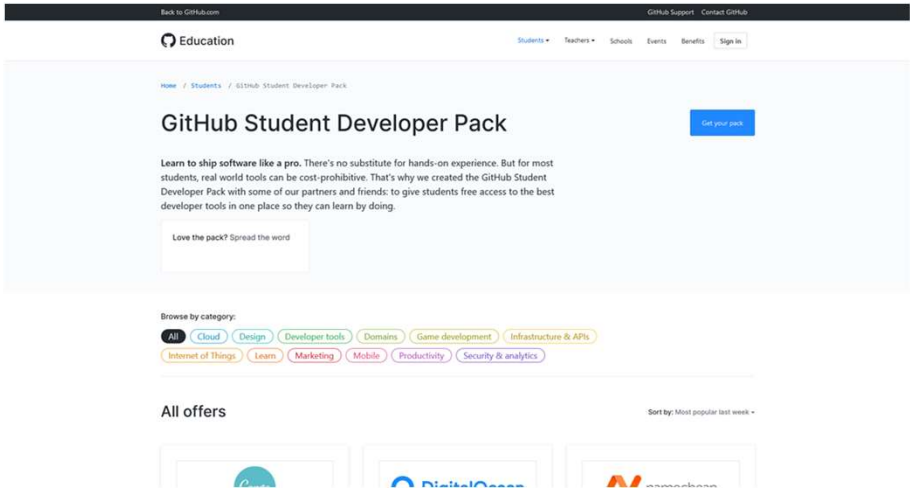
A “TXT Record,” or, “Text Record” can be used for storing any text along with your domain. Generally, it is not often used for notes and comments, as favour for its use has shifted to including additional configuration or validation data for use by mail servers or web services. For example, to enhance mail security and deliverability, it is common for an “SPF” (Sender Policy Framework) TXT Record to be added. Certain services may read your zone file for specifically formatted TXT records for purposes like these.

Domain Resources

Websites like Freenom may offer some options for free domains. The selection and reliability of these domain options may not be as high as a paid option, but it might offer enough flexibility to experiment with domain configuration or representing a website for free.



To find a number of amazing domain discounts, trials, and resources it can be useful to check out the GitHub Student Developer Pack!



Recommended Readings

If you'd like a more in-depth look at domains, DNS, and zone files have a look at:

- https://developer.mozilla.org/en-US/docs/Learn/Common_questions/How_does_the_Internet_work
- Liu, C., Albitz, P. (May 2006). *DNS and BIND, 5th Edition.* O'Reilly Media, Inc.