LESSON 12: THE NEED FOR DNS

Goals:

- Give a high level description of DNS as a name-to-IP-address mapping system used on the Internet
- Give a few reasons why DNS is useful and necessary
- Describe at least one vulnerability of DNS and how an attack on it works

GETTING STARTED

- Hold on to your IP address
- Do not share it
- Await Instructions (sign in to Google and Code.org)

DNS Unplugged - Instructions

- When you walked in, I handed you a slip of paper with an IP address on it.

- You also should have a Names and Addresses – Worksheet

- For the next 5 minutes, your goal is to complete an accurate list of IP addresses and names for all students in the room.

- You may only talk to one person at a time, but you may exchange as much information with that person as you want.

- GO!

Background Information

- When computers talk to one another on the web, they don't refer to each other by names; they use an IP address to indicate who they are and who they are sending a message to.

- Without this system, the packets would be impossible to route across the Internet

- The problem with this system is that, while computers are fine with referring to other computers by numbers, humans are really terrible and remembering long strings of seemingly-random numbers.

- We'd prefer to identify a web page by its name, and besides, it makes remembering our favorite locations on the Internet ("Code.org" vs. 174.129.14.120)

DNS Unplugged Discussion

- Why did I keep taking your IP addresses?
  - This simulates the fact that a computer's IP address does not stay the same.
  - For example: a person's IP address on their phone changes quite frequently as they move around throughout their day and their phone tries to connect to the Internet from different locations
  - IP addresses change all the time
- Do you think the system we just simulated is an efficient way of collecting IP addresses? Are there any inefficiencies you observe? How could it be made better?
  - A central list of IP addresses would be better, and the Internet has a system for that.

INTERNET SIMULATOR ACTIVITY

- Using the DNS Partner Questionnaire – Activity Guide you are going to work through the next activity

- New simulator:

  - A DNS server now appears attached to every router

  - We no longer can see anybody's IP address. To get an IP address, we have to "ask" the DNS servor using a text-based protocol.

  - This demonstrates how to send a request to the DNS for someone's address. Let students try the DNS protocol to get the address of someone who is attached to their router.

DNS IN THE INTERNET SIMULATOR

- When you go to the Internet Simulator now, you will see a "DNS server" attached to the router. In order to communicate with someone else, you must first find their IP address by asking the DNS.
  - To begin, click over the "DNS" tab to see all the hostnames of people on the router. You will see the address of the DNS (always 15) but will not see an address for anyone else on the router.
  - The DNS server responds to a text protocol that will give you someone's IP address. The protocol is:
    - GET <hostnameOfPerson>
  - After the DNS has returned an IP address, you can type that IP address into the "To" field, enter a message, and then press "send."

NOW GO AHEAD…

- Complete the activity guide
- You are going to interview someone
- Note: if I say so, you both MUST disconnect and reconnect from the simulation. This is to simulate changing IP addresses
- Your hostname will stay the same

WHY THE CHANGING IP ADDRESSES?

- Especially in a world of mobile devices it is very common to lose an IP address and re-aquire one – entering a tunnel, flying on a plane, or changing WiFi hotspots

- It's true that sites like Code.org or Google.com is less likely to change IP addresses, but if it did, the DNS would take care of that. (also these sites often have huge operations that serve their sites on multiple computers)

- Analogy: changing phone numbers (DNS makes this process way easier)

VIDEO: DNS

- http://youtu.be/5o8CwafCxnU?t=4m12s
- Let's finish filling out that guide from when we watched the first half of this video

RAPID RESEARCH: DNS AND DDoS ATTACKS

- Hopefully we all get the basic idea: the DNS is the large-scale system that translates human-readable web addresses into their numeric IP addresses so that computers can communicate.

- This system however was not designed to be secure and that has resulted in some major security incidents over time

- You're now going to learn about some of them and how they work.

Rapid Research: DNS and DDoS attacks - Intro

- You are going to fill out the Research: DNS in the Real World – Activity Guide – page 1
- I'm going to assign you an article on Code Studio (Stage 12)
- Read the article
- You can work with your group to complete the activity guide.

Jigsaw:

- I'm going to count you off so you are now in a group with a different article
- Exchange information you learned with one another, recording key points from each article in the space provided on the second page of the activity guide.

WRAP-UP: WHAT IS DNS?

- Why does the Internet use IP addresses?
- Why don't we need to know IP addresses?
- Why do we need a Domain Name System?
- Why don't we all maintain our own DNS?
- Is there one big DNS for the entire Internet?
- How do you think all these DNS servers are maintained?
- What is one vulnerability of DNS and how is that vulnerability attacked?
- What are the implications of an attack on a DNS server (or servers) – how does this affect your life?

Discussion:

- The Internet is basically a network of computers sending messages to request information and computers replying to messages to satisfy information requests. (computers use numbers to identify "from" and "to")

- All communication online is via IP addresses. However, we are more familiar with human readable names, most notably URLs like "Code.org"

- We need a way to translate human-readable names into IP addresses

Discussion:

- It is inefficient for everyone on the Internet to maintain a table of IP addresses

- The DNS is NOT centralized, but it's not completely autonomous and distributed like routing, either. There is a hierarchical system of servers to maintain an authoritative table that, like a phone book, others can consult when they need to find an address.

- A properly functioning DNS system requires collaborative efforts among all users to ensure it is up to date and accurate.

DNS – At the Core

- "simply" a hierarchical system of computers and databases, that maps IP addresses to domain names

- It enables Internet users to connect human-language locations on the Internet with numeric addresses used by IP