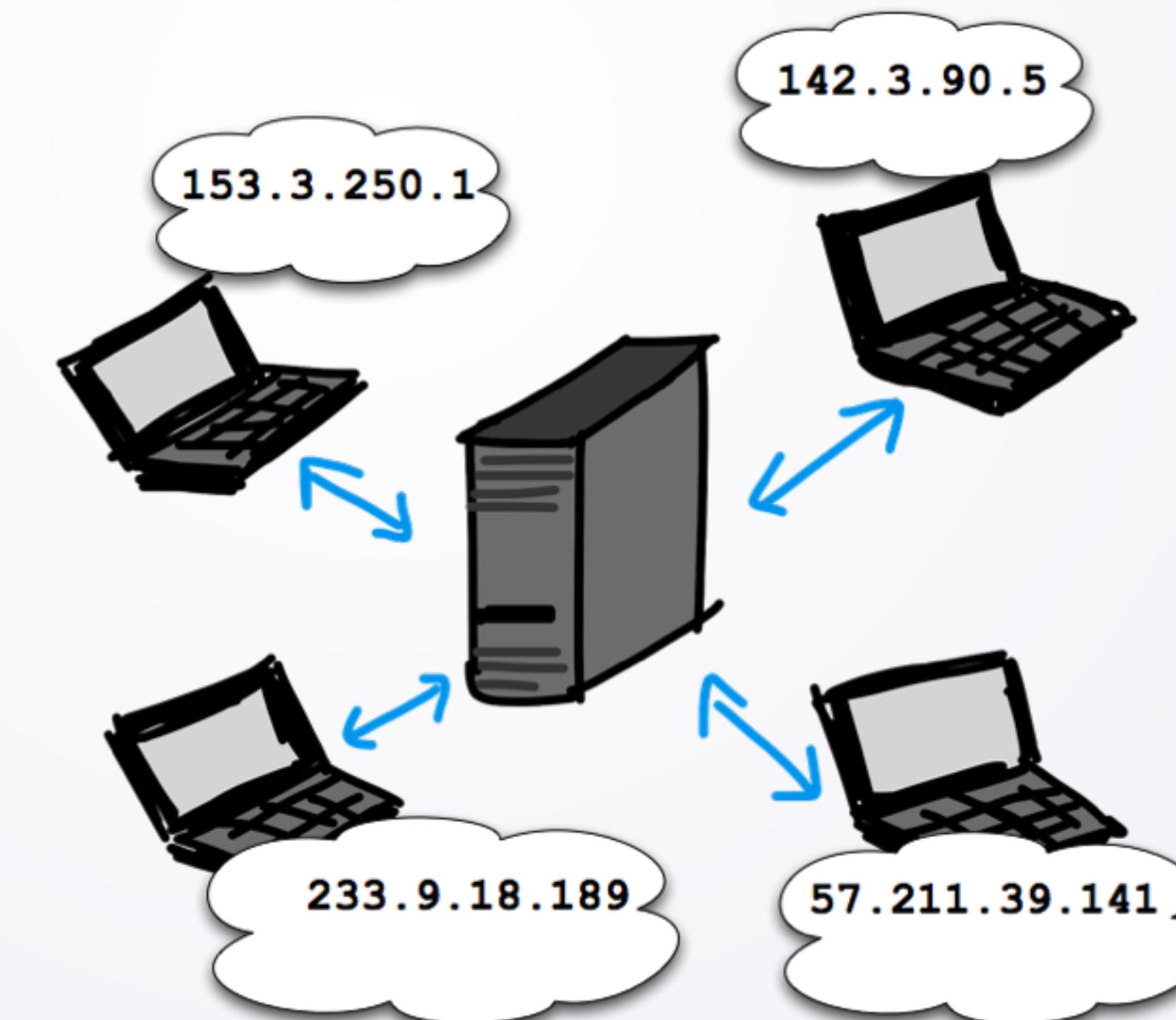


# **Internet, Web, and Communication**

# Understanding How Web Pages Work

- Connect a computer/device to the Internet
  - Many users can do this at the same time
  - Each user's device gets an address



# Understanding How Web Pages Work

- Connect a computer/device to the Internet
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- Internet Protocol Address, IPv4 or IPv6



IPv4 — 54.68.155.51

IPv6 — 2600:1408:10::b833:6c31

# Understanding How Web Pages Work

- Connect a computer/device to the Internet
  - Many users can do this at the same time
  - Each user's device gets an address
- Internet Protocol Address, IPv4 or IPv6
  - New protocol helps scale
  - Internet of Things
  - More people online too

**IPv6 addresses =  $2^{128}$**

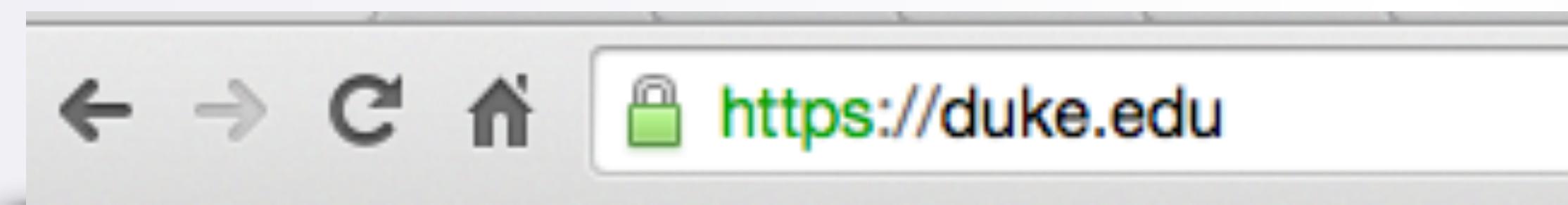
# Find URL, Get Page from Web Server

- Why do we use URLs like duke.edu?



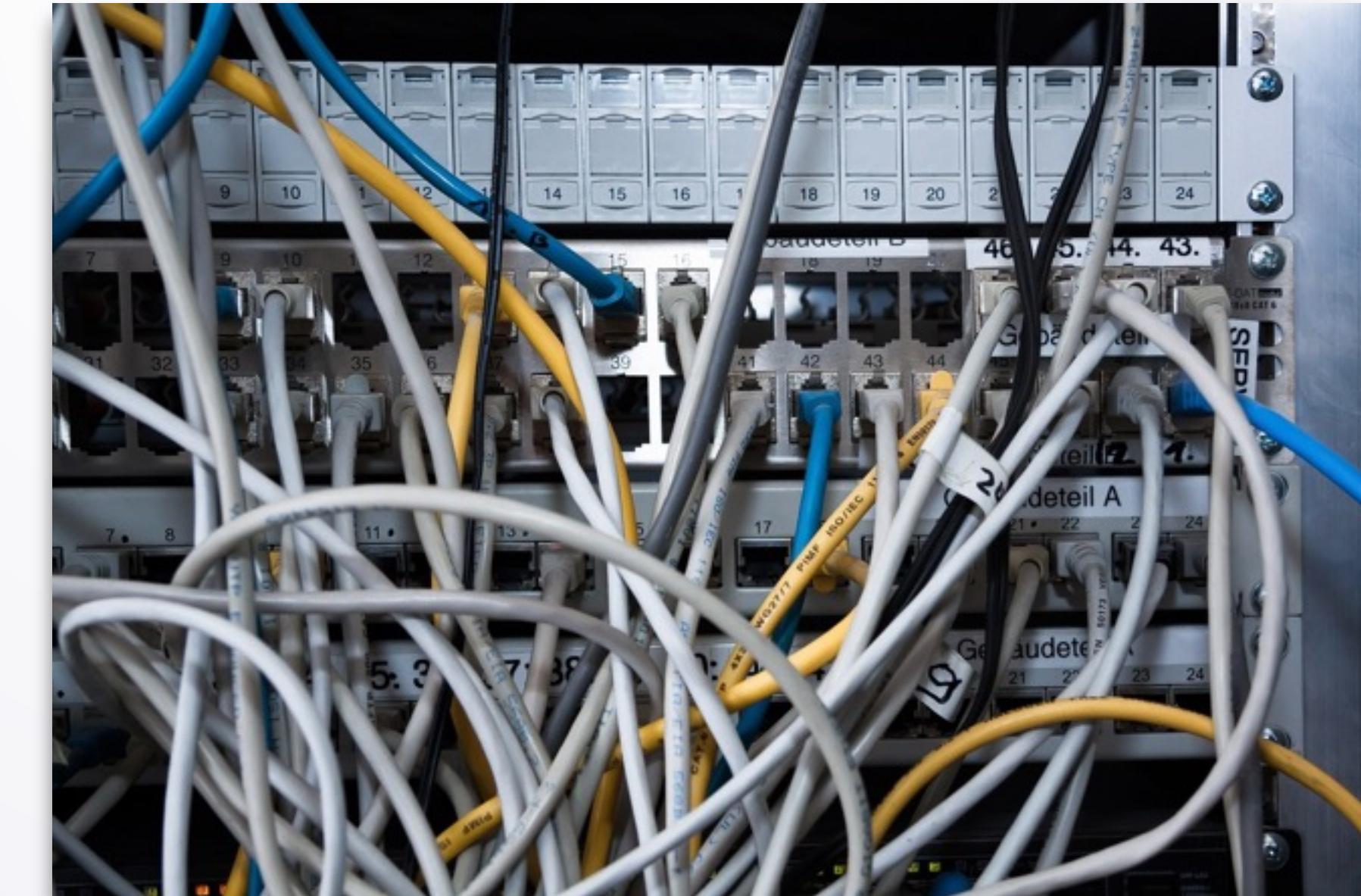
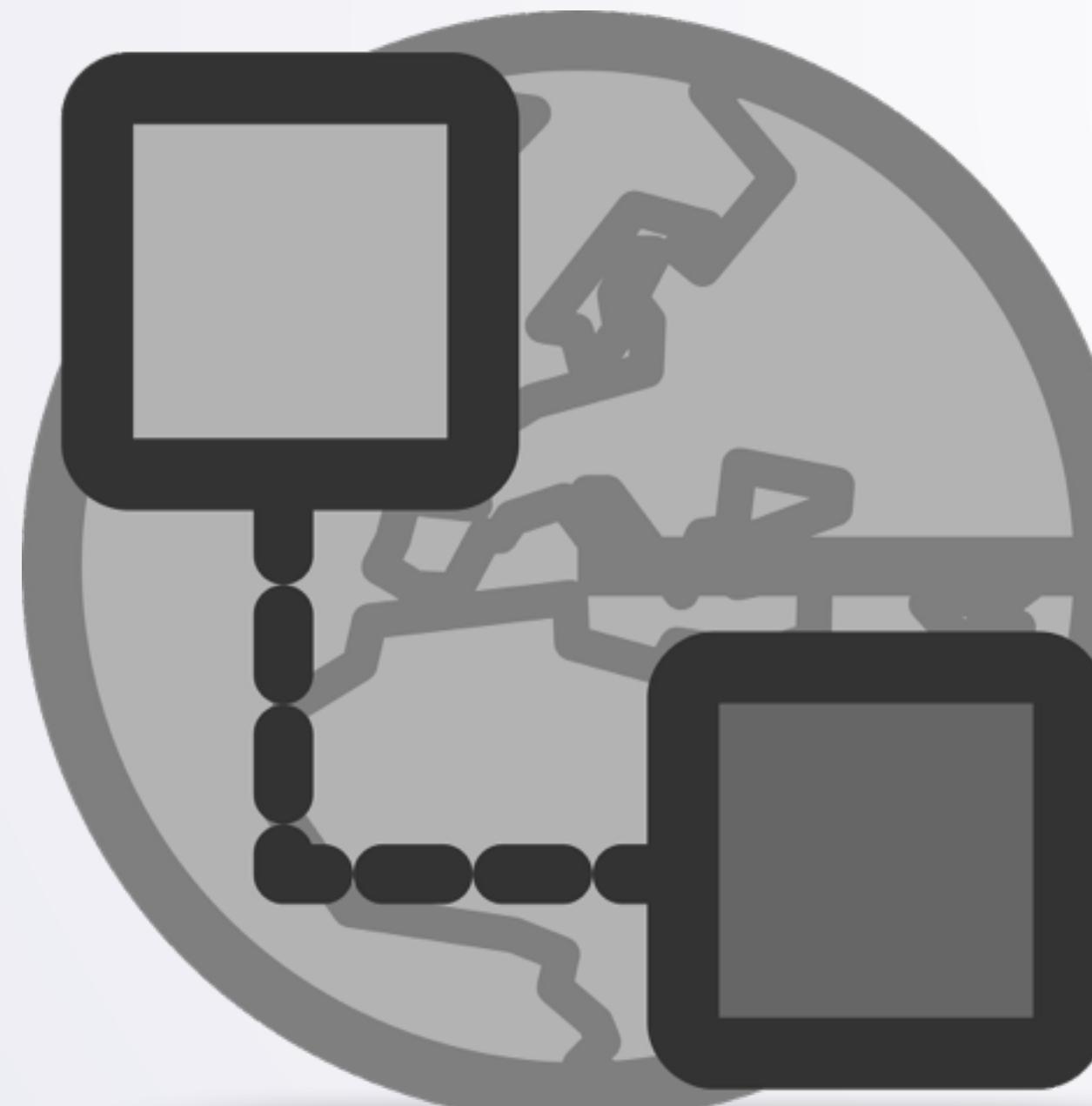
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- Why do we use URLs like duke.edu?
  - DNS Finds IP address of web server for URL
  - Connect from computer to 54.68.155.51



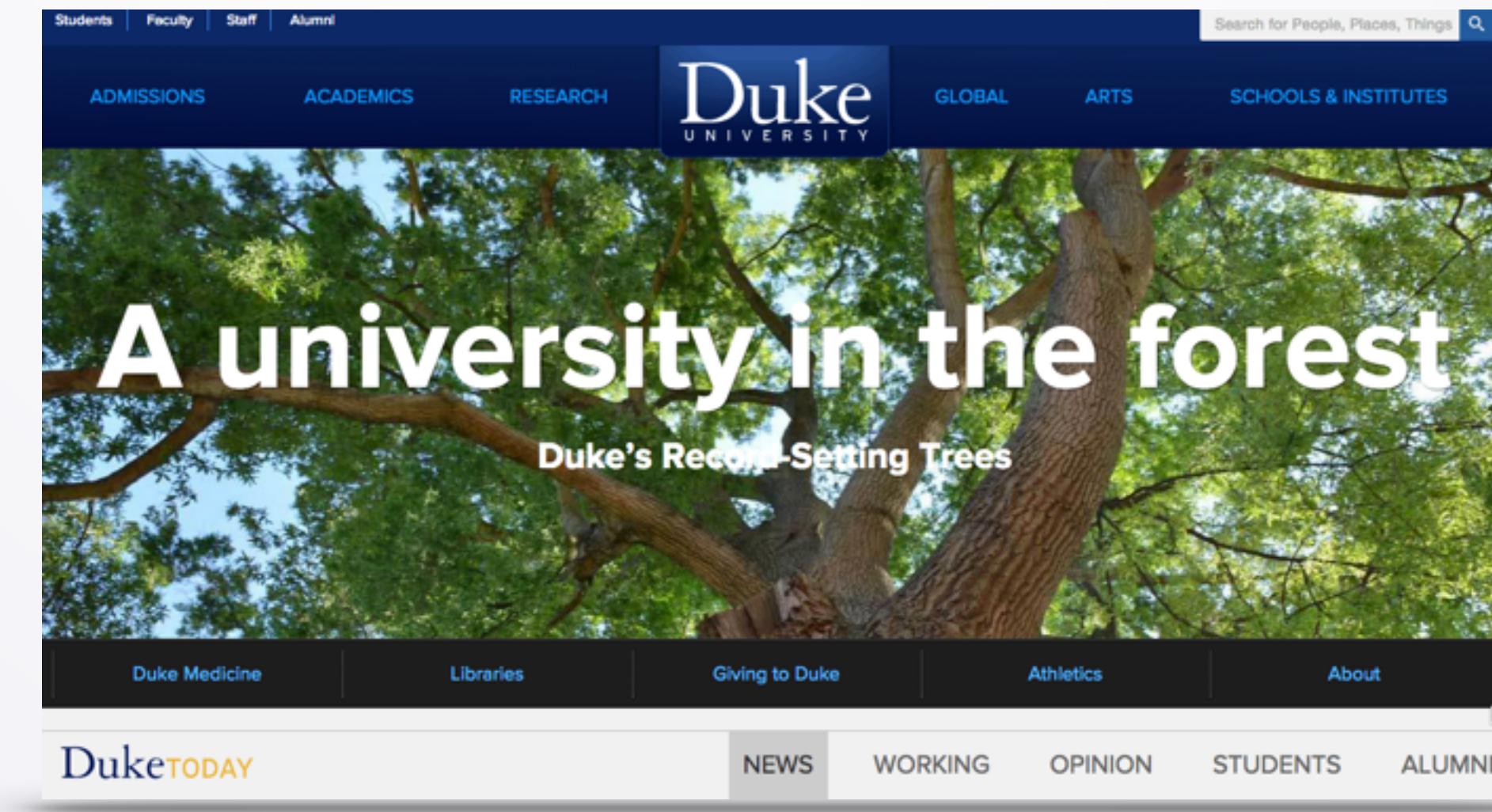
# Find URL, Get Page from Web Server

- Why do we use URLs like duke.edu?
  - DNS Finds IP address of web server for URL
  - Connect from computer to 54.68.155.51
  - Internet Route to Server



# Sending Web Page to User

- Web server knows who requested page so can send content to that user
- Web page has text, images, and more
  - Image address 2600:1408:10::b833:6c31
  - Web analytics: 2607:f8b0:4002:c06::8b



# Web Page Divided into Packets

- Physical goods often shipped in containers
  - Start and end in different places, ship between



# Web Page Divided into Packets

- Physical goods often shipped in containers
  - Start and end in different places, ship between
- Web page divided into network packets
  - IP address of sender known
  - IP address of recipient known
- Internet Protocols help
  - Resend lost packets
  - Resend damaged packets
  - Different routes possible



# What Is a Web Browser?

- Software: runs on mobile device or computer, displays web pages
  - Chrome, Safari, IE, Firefox, Opera
  - Each can receive web pages and show them to user, other functionality as well
  - Secure browsing increasingly important



Firefox logo by Sean Martell (Mozilla)/CC-by-3.0

# What Is a Web Server?

- Serves content: web pages, images, text, to many clients simultaneously
  - Software that likely runs on more powerful computers, but can run on your laptop!



# What Is a Web Server?

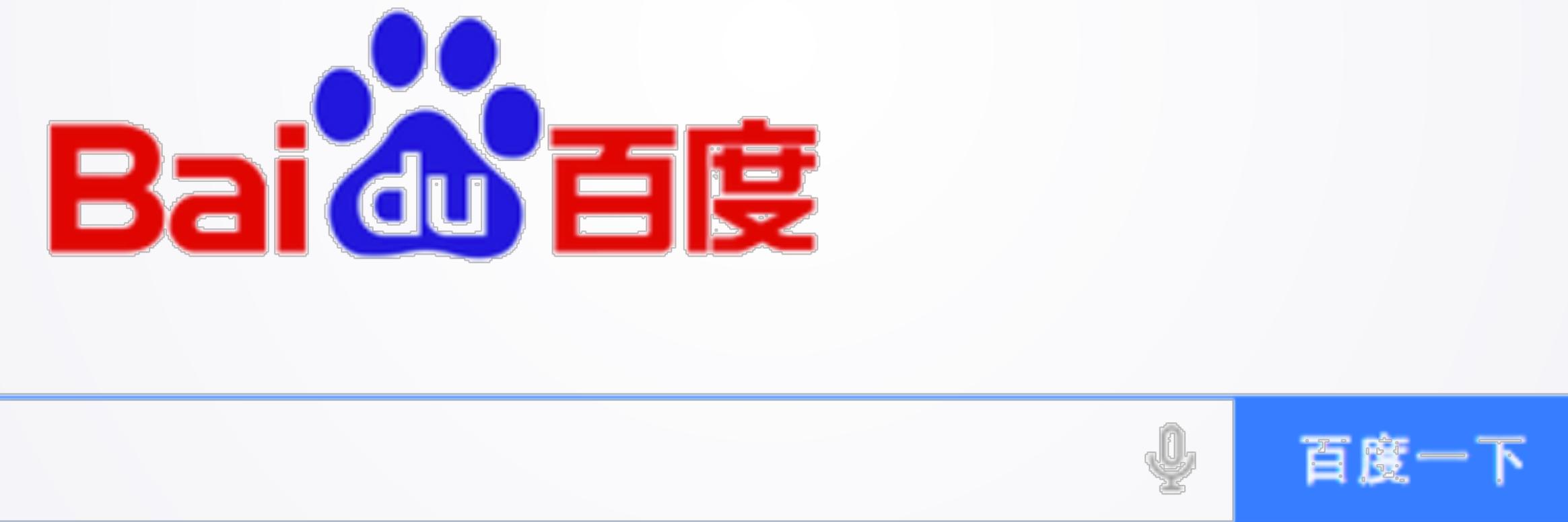
- Serves content: web pages, images, text, to many clients simultaneously
  - Software that likely runs on more powerful computers, but can run on your laptop!
  - Apache, NGINX, IIS



**NGINX**    **IIS**

# Cyberconcerns: Mistyped URLs

- You want to visit baidu.cn or baidu.com



# Cyberconcerns: Mistyped URLs

- You want to visit [baidu.cn](https://baidu.cn) or [baidu.com](https://baidu.com)
  - You type [byedue.com](https://byedue.com) instead

**Duke and Coursera: Introduction to Programming and the Web**



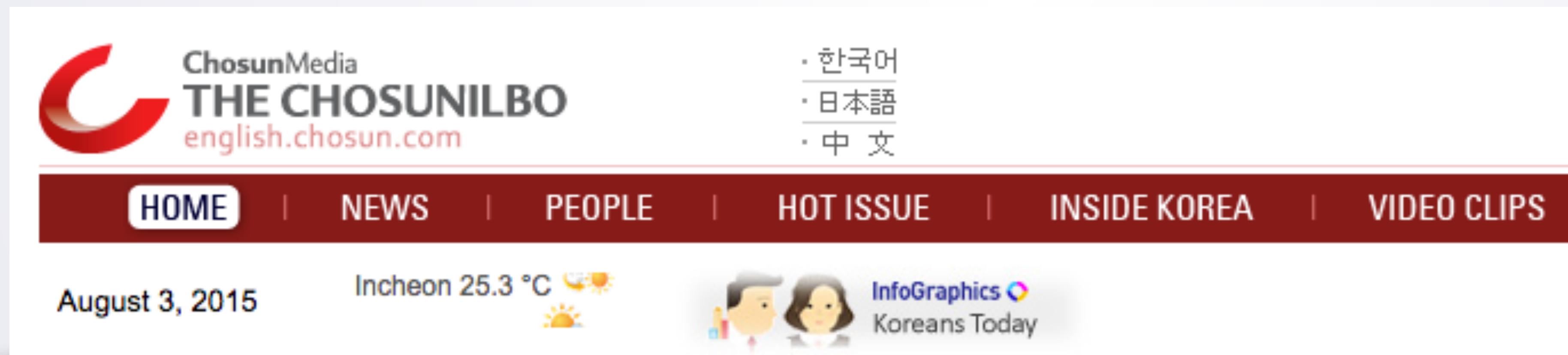
# Cyberattack: Hijack DNS

- Instead of 103.235.46.39 for [baidu.com](https://www.baidu.com)



# Cyberattack: Hijack DNS

- Instead of 103.235.46.39 for [baidu.com](http://baidu.com)
  - Substitute 218.145.28.83 either on the user's machine, or before real IP address obtained
  - How will user know?

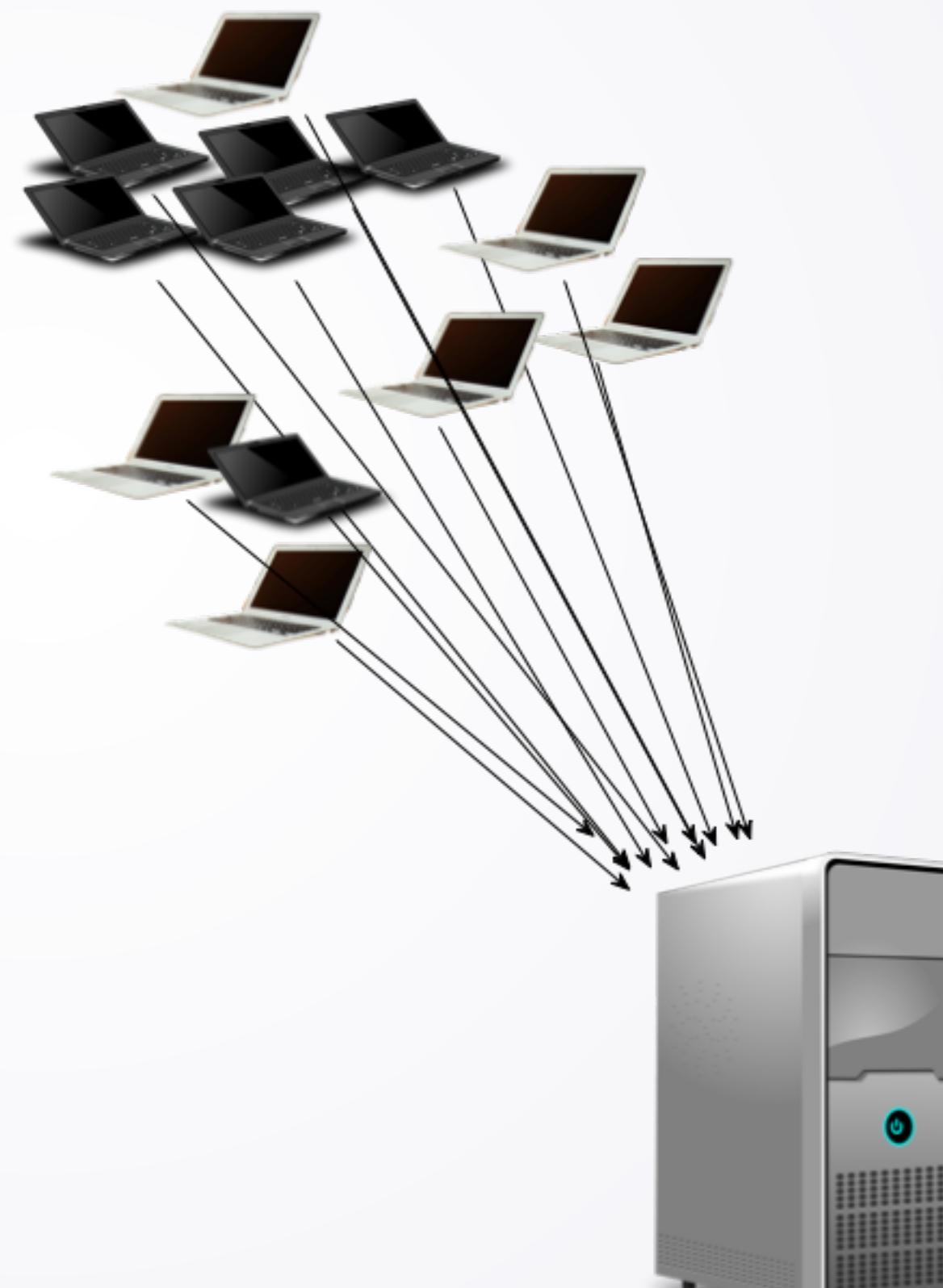


# DDOS: Distributed Denial of Service

- Can [duke.edu](http://duke.edu) serve web page to thousands of users at the same time?
  - Millions at same time?
- Coping with (bad) traffic
  - CDN and other solutions



CloudFlare logo by CloudFlare



web server attacked by DDOS

# Safety on the Web and the Internet

- It's safe to conduct business, view web pages, and be entertained online!
  - Knowledge of web and internet can help

