CSCI 466: Networks

Introduction, Syllabus, and Logistics

Reese Pearsall

Fall 2024

https://www.youtube.com/watch?v=2c6pQDfFacY

Communication in the Digital Era

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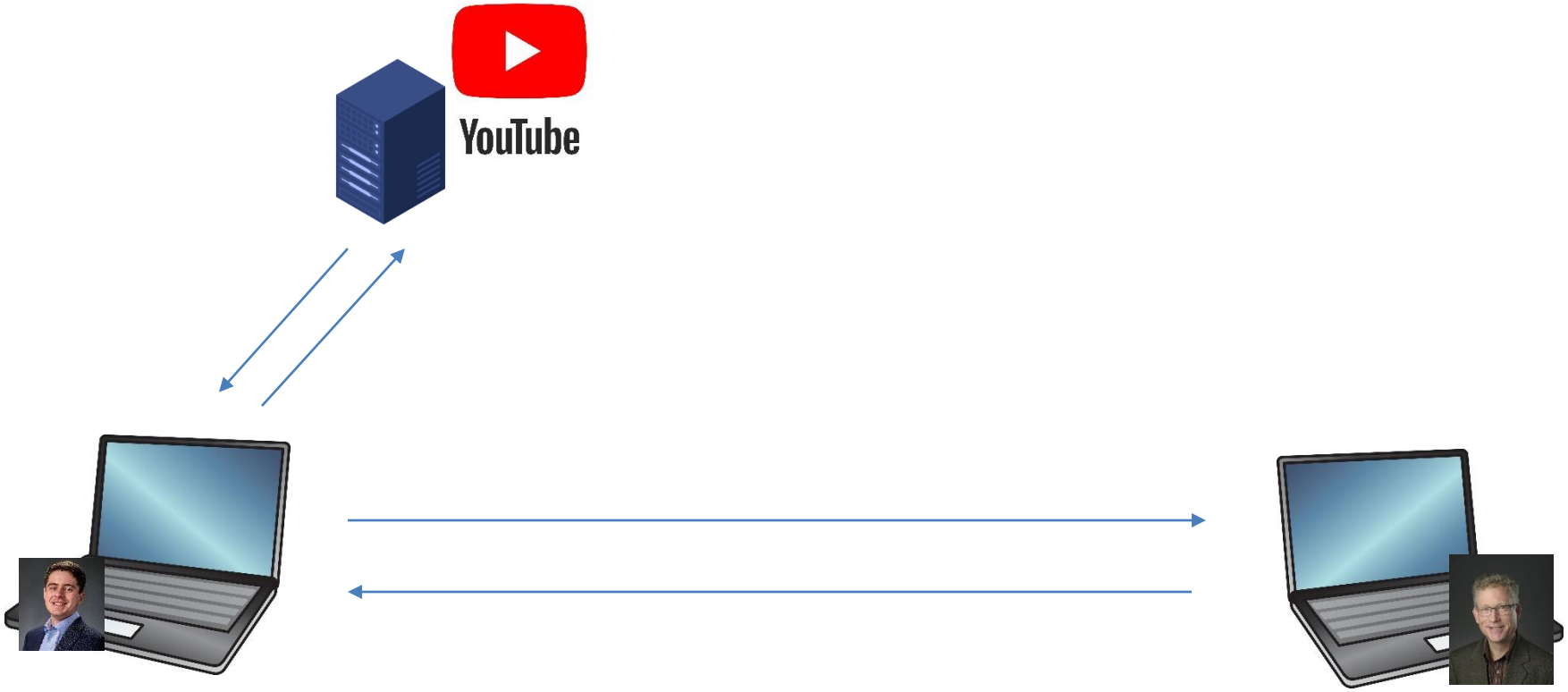

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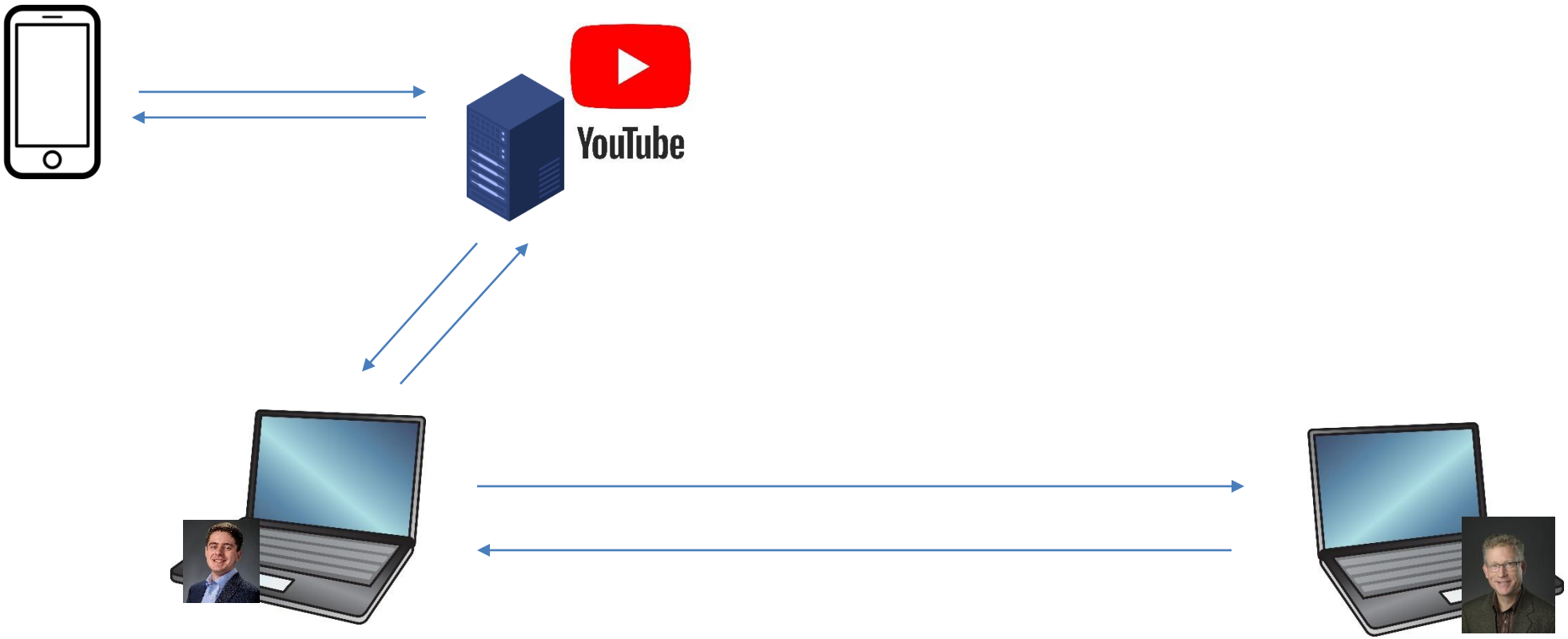

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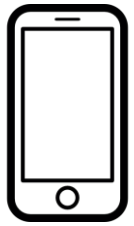

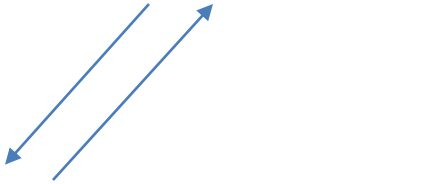

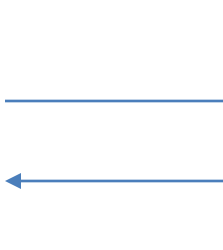

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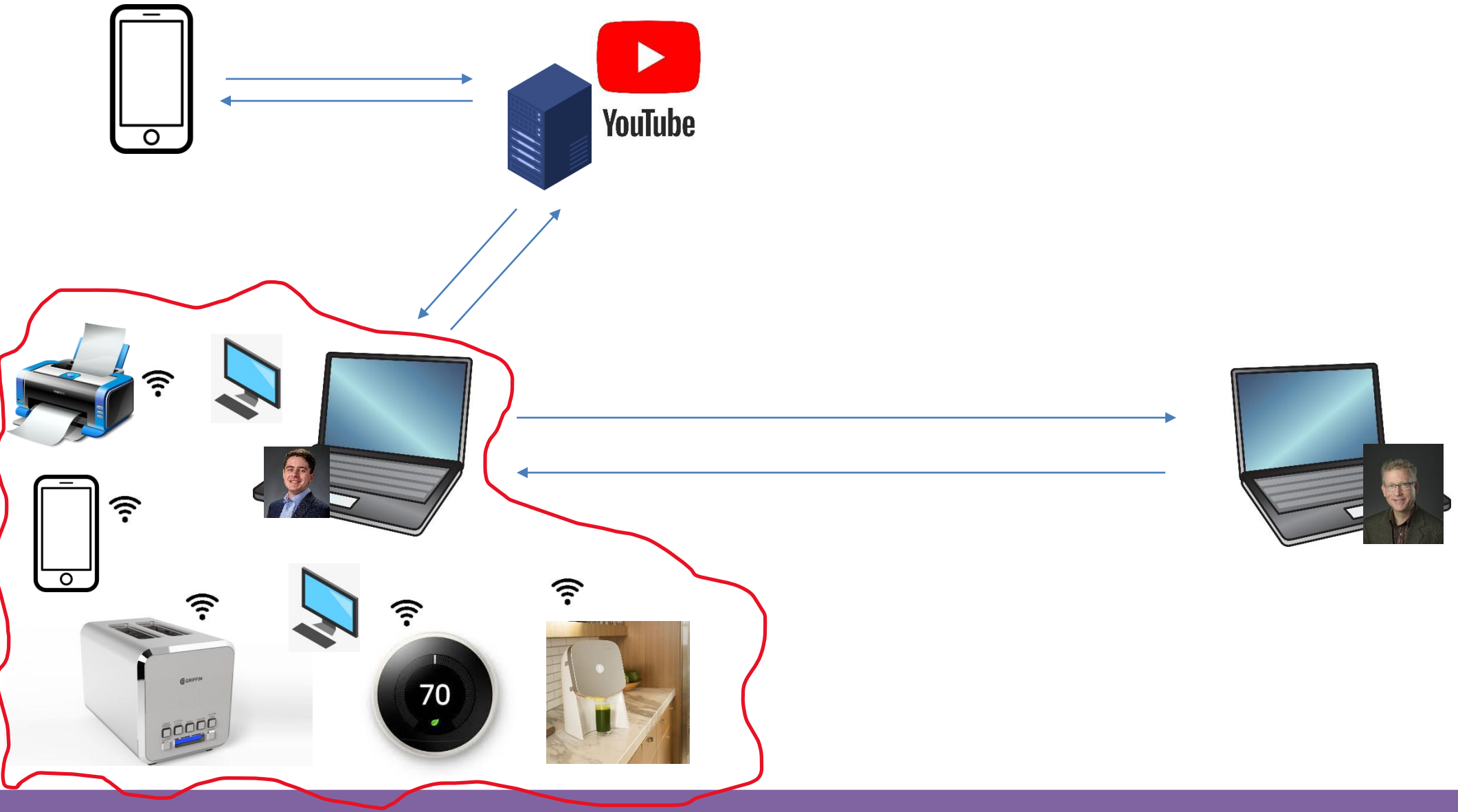

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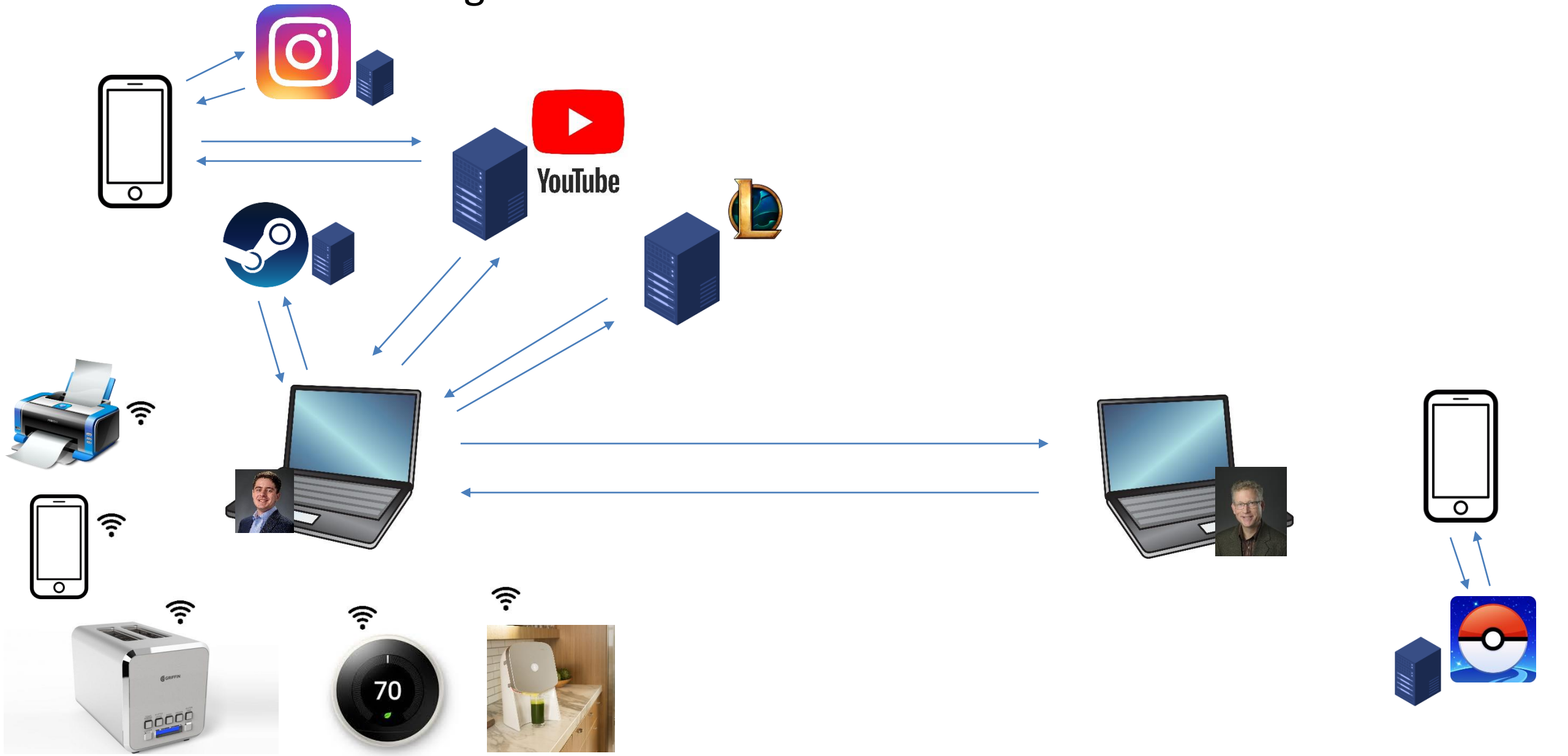

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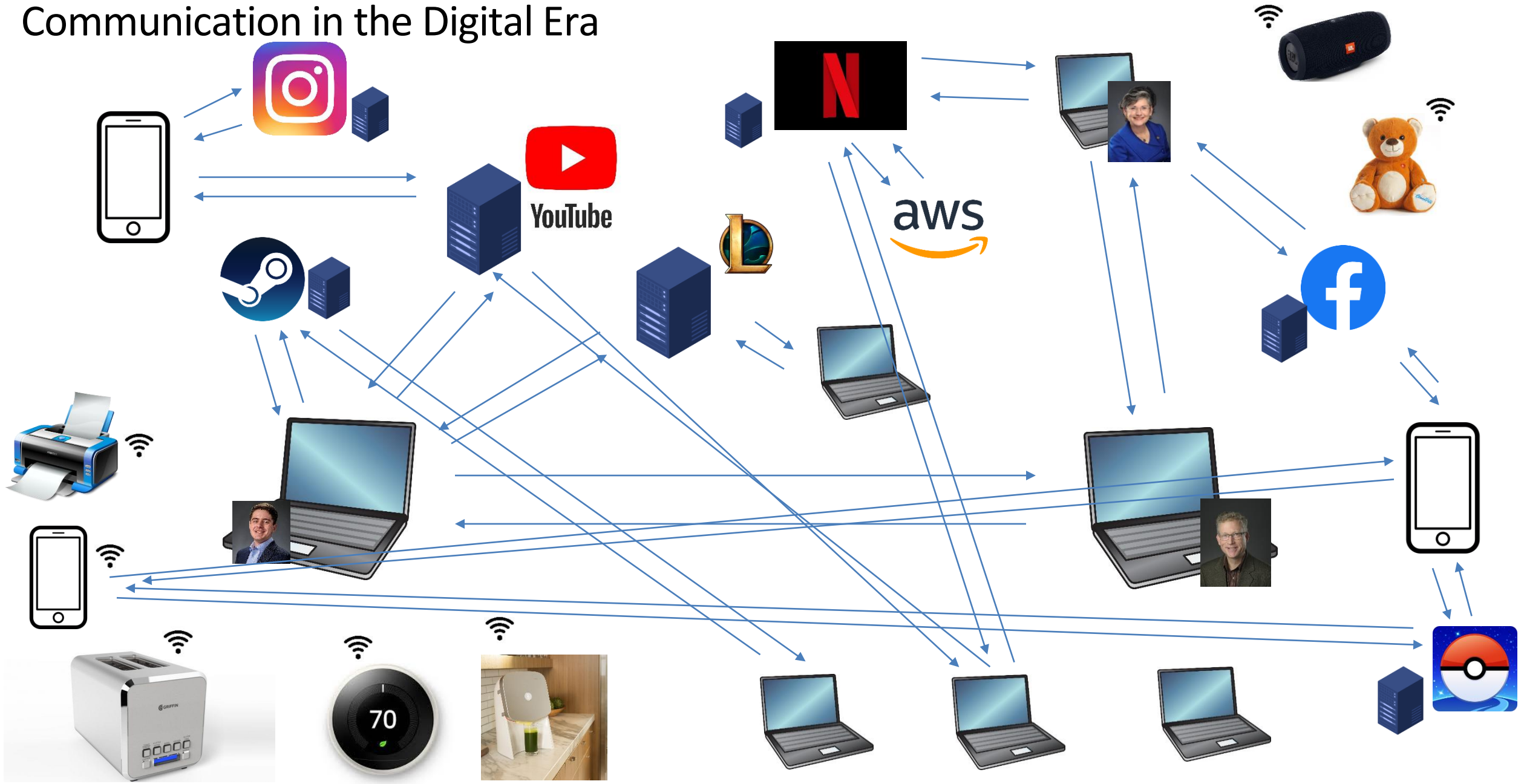

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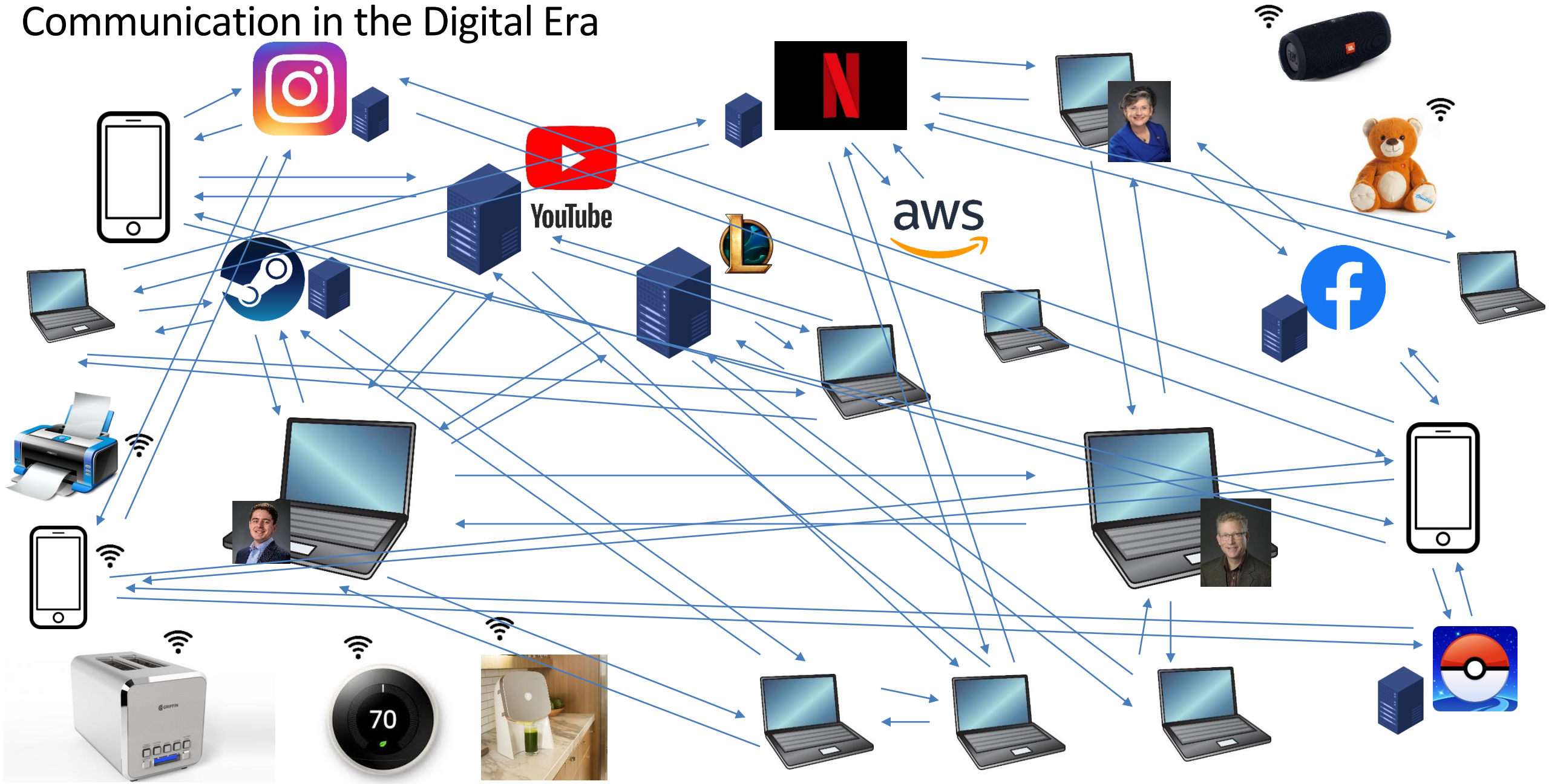

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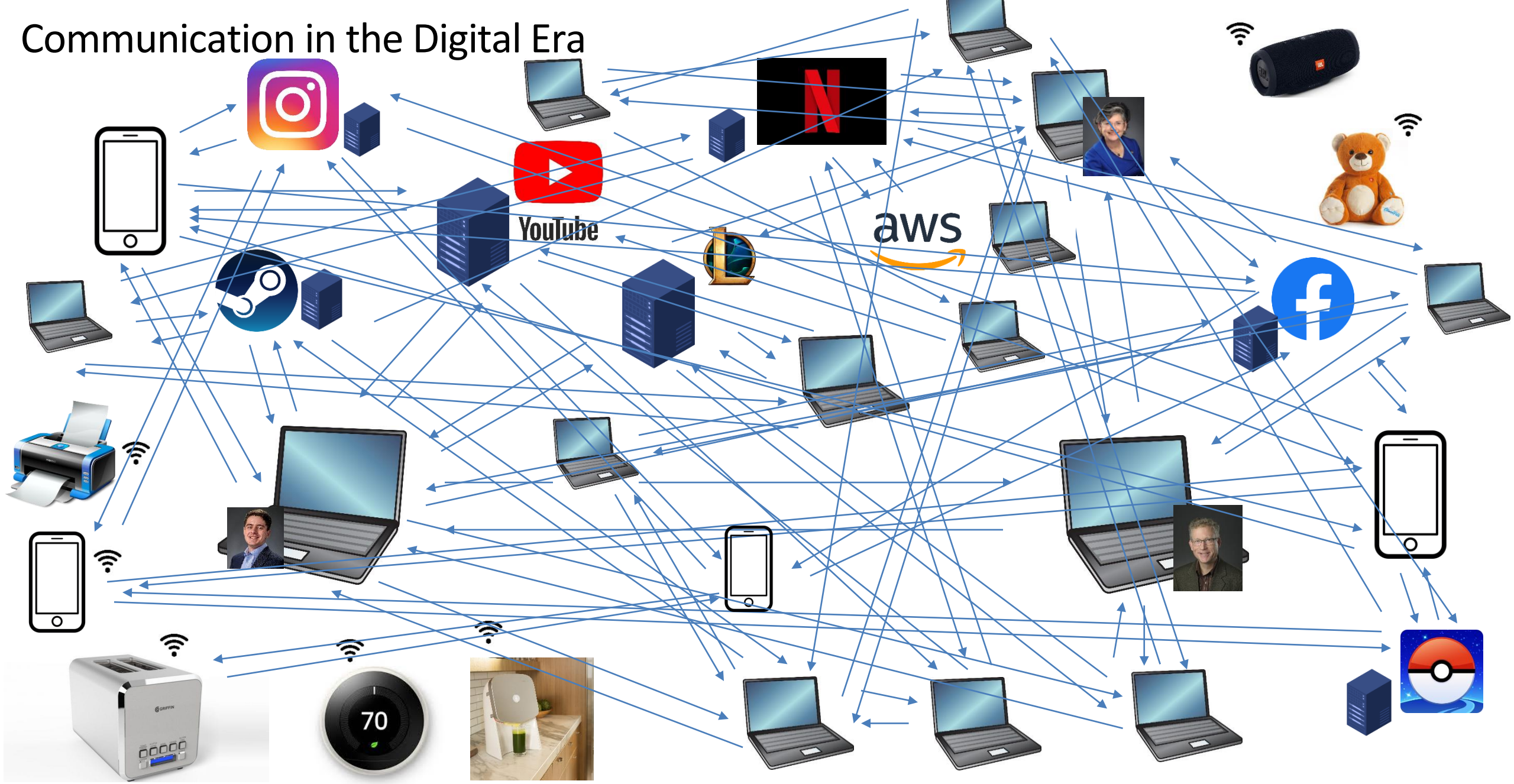

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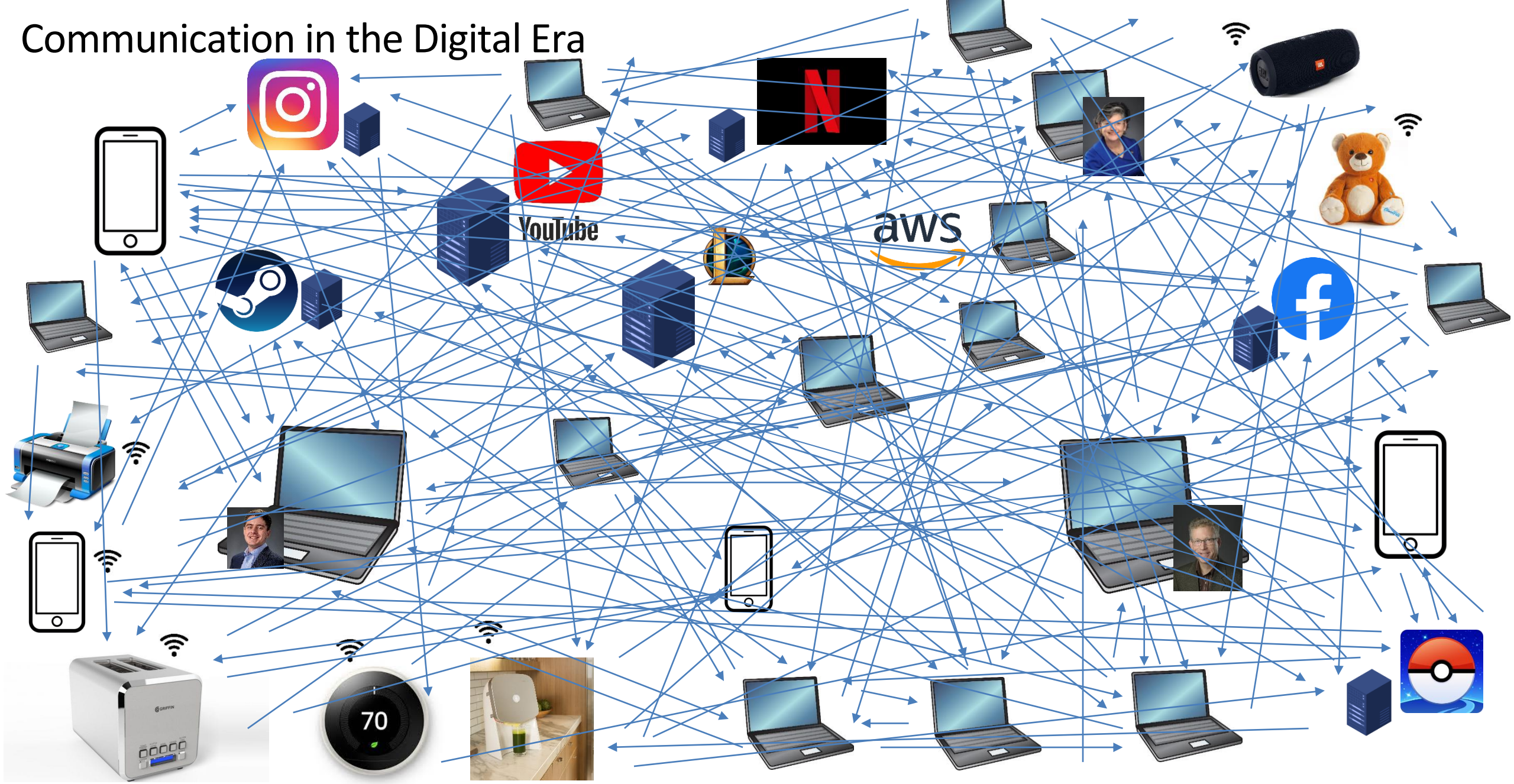

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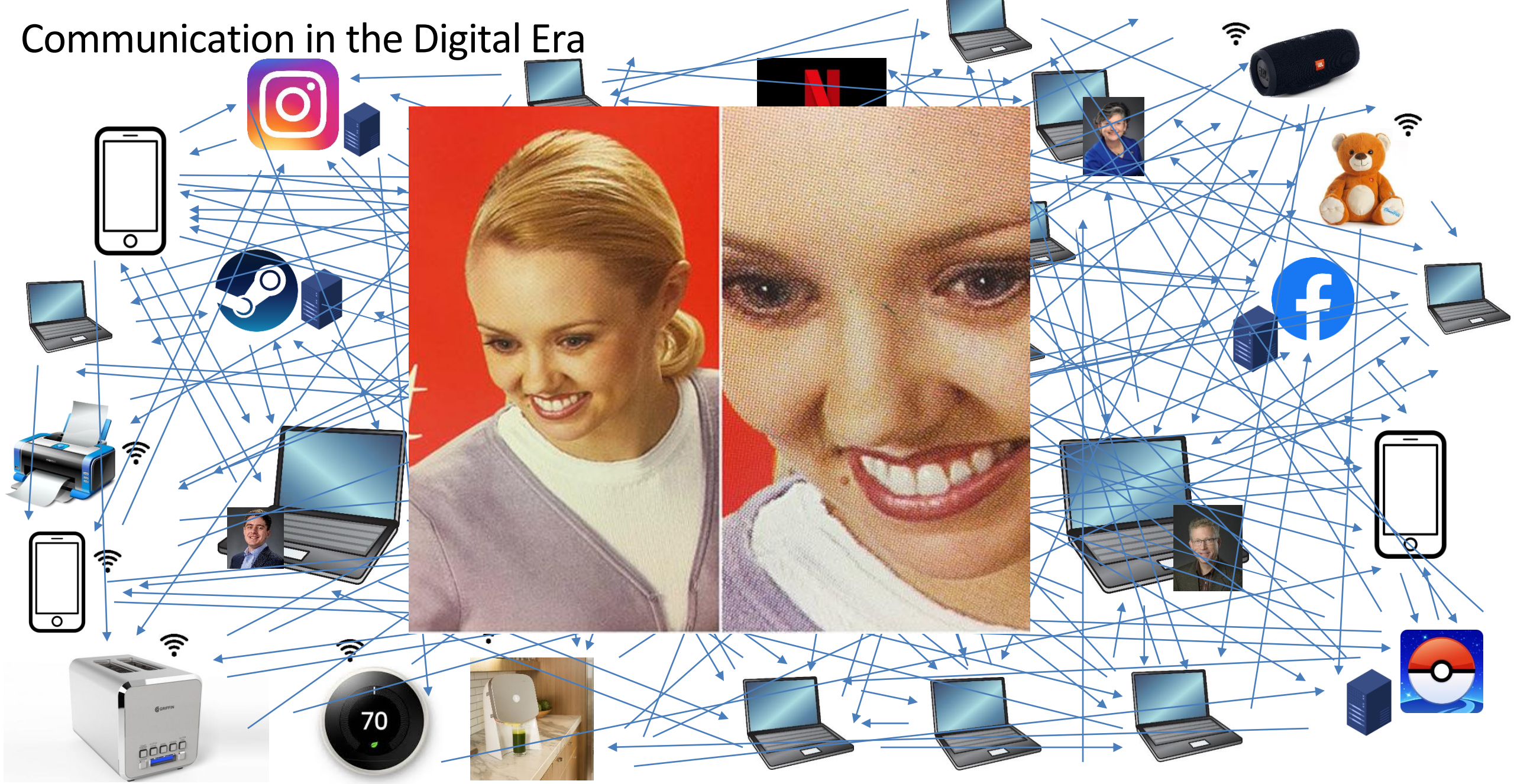

Communication in the Digital Era

There were **5.3 billion** active internet users around the world in 2023

We have **billions** of devices that are constantly communicating with one another

Internet users* make **trillions** of web requests per day

Facebook generated four petabytes of data every day in 2023.

_____ account for over 80% of internet traffic

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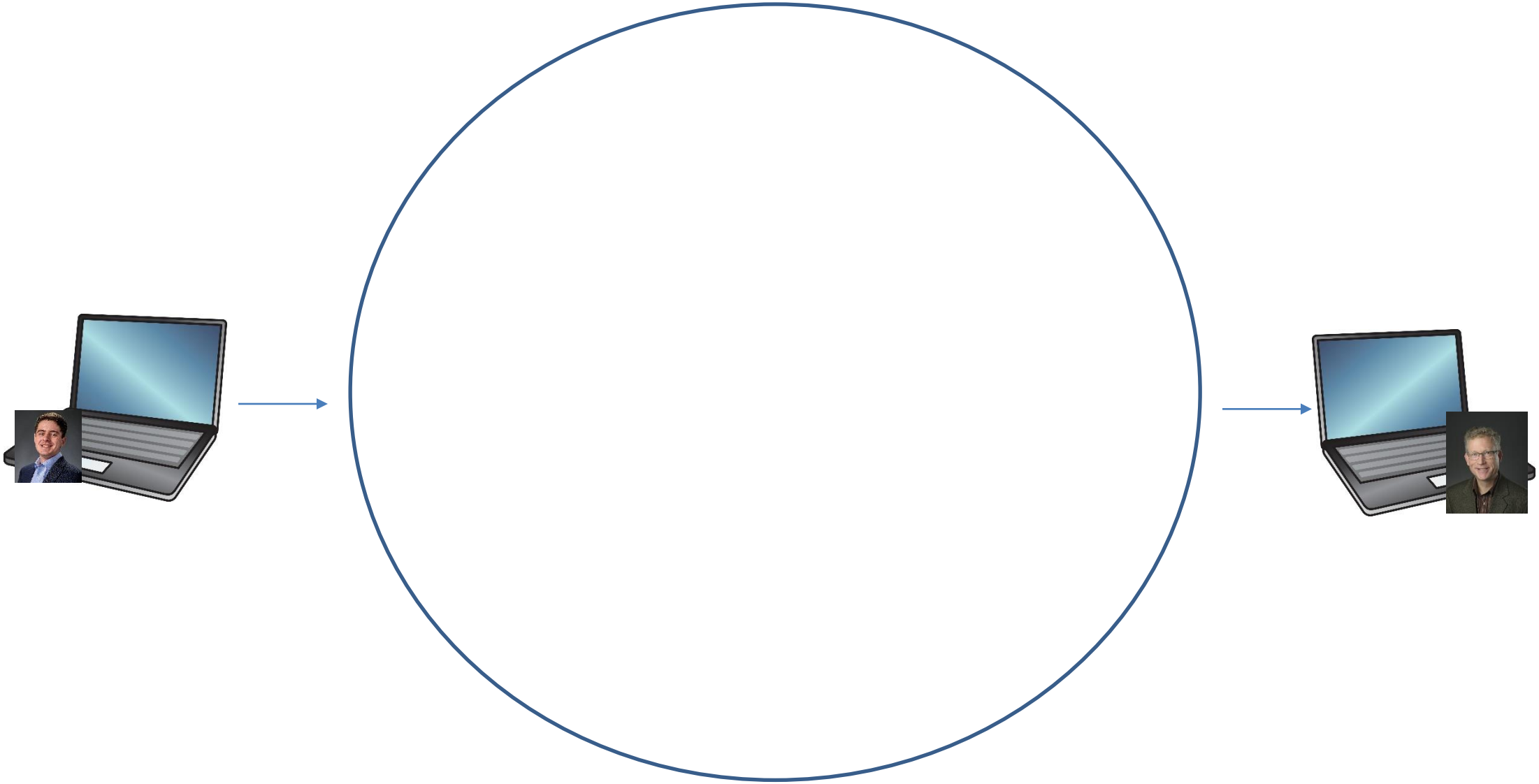
Video Content account for over 80% of internet traffic

Communication in the Digital Era



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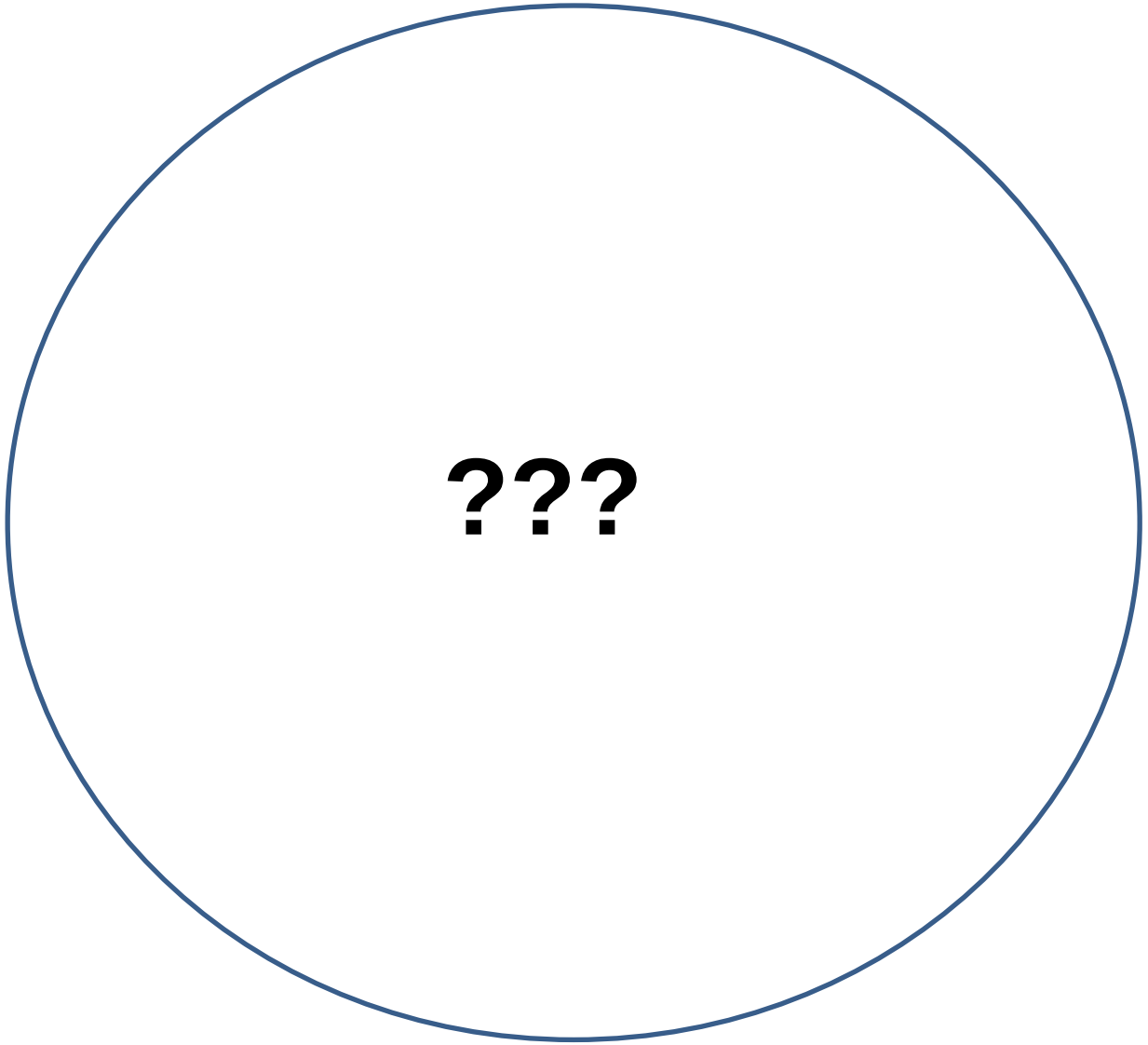

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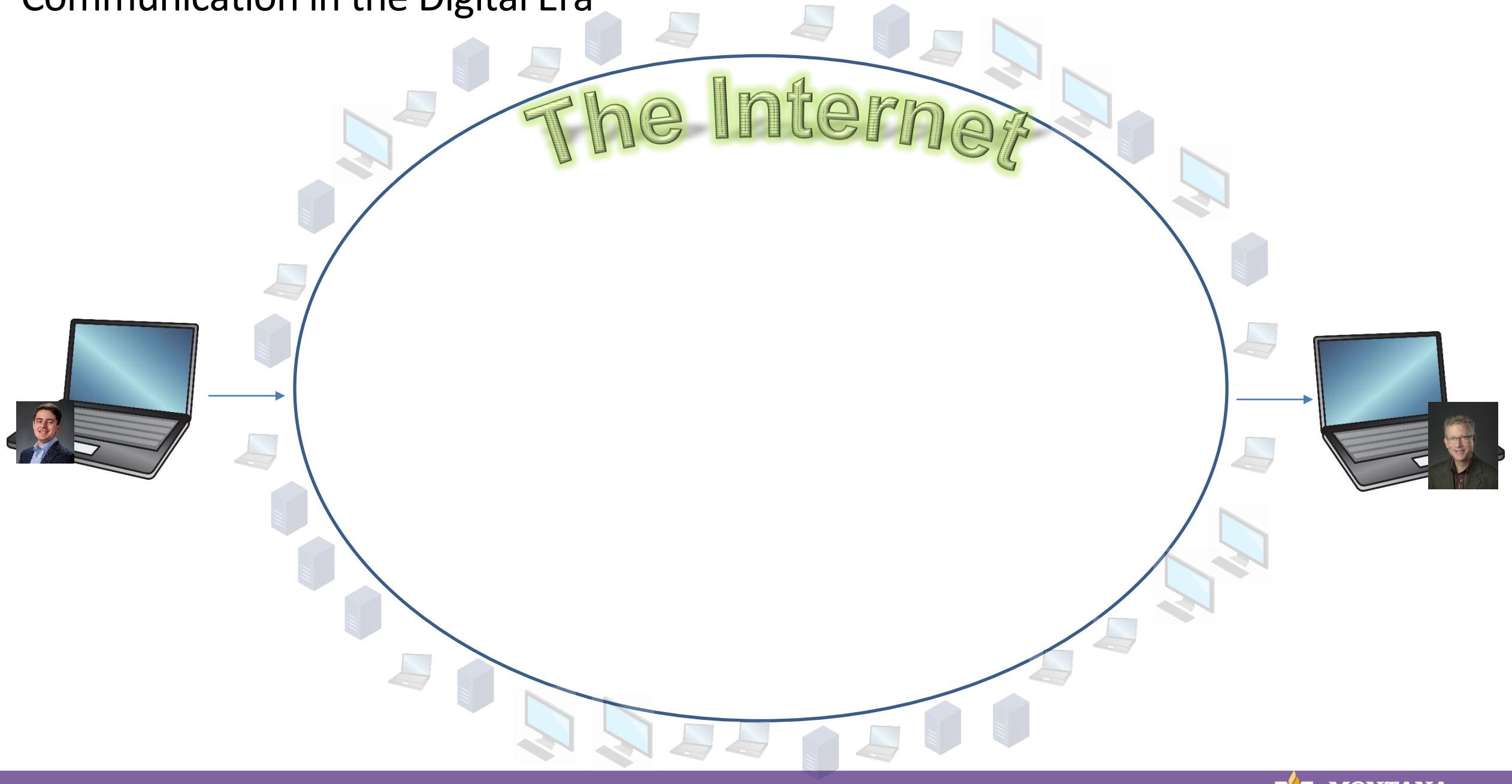

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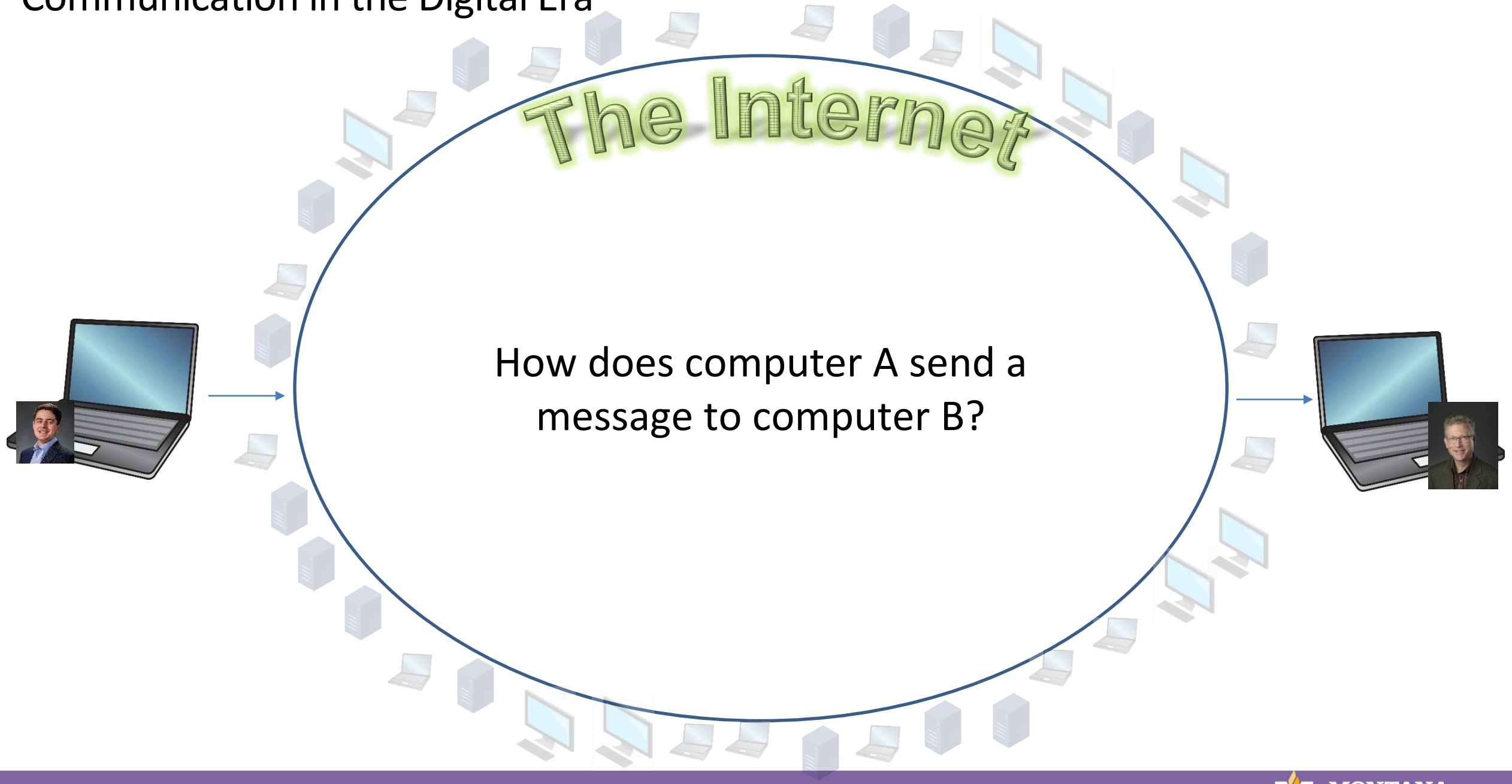

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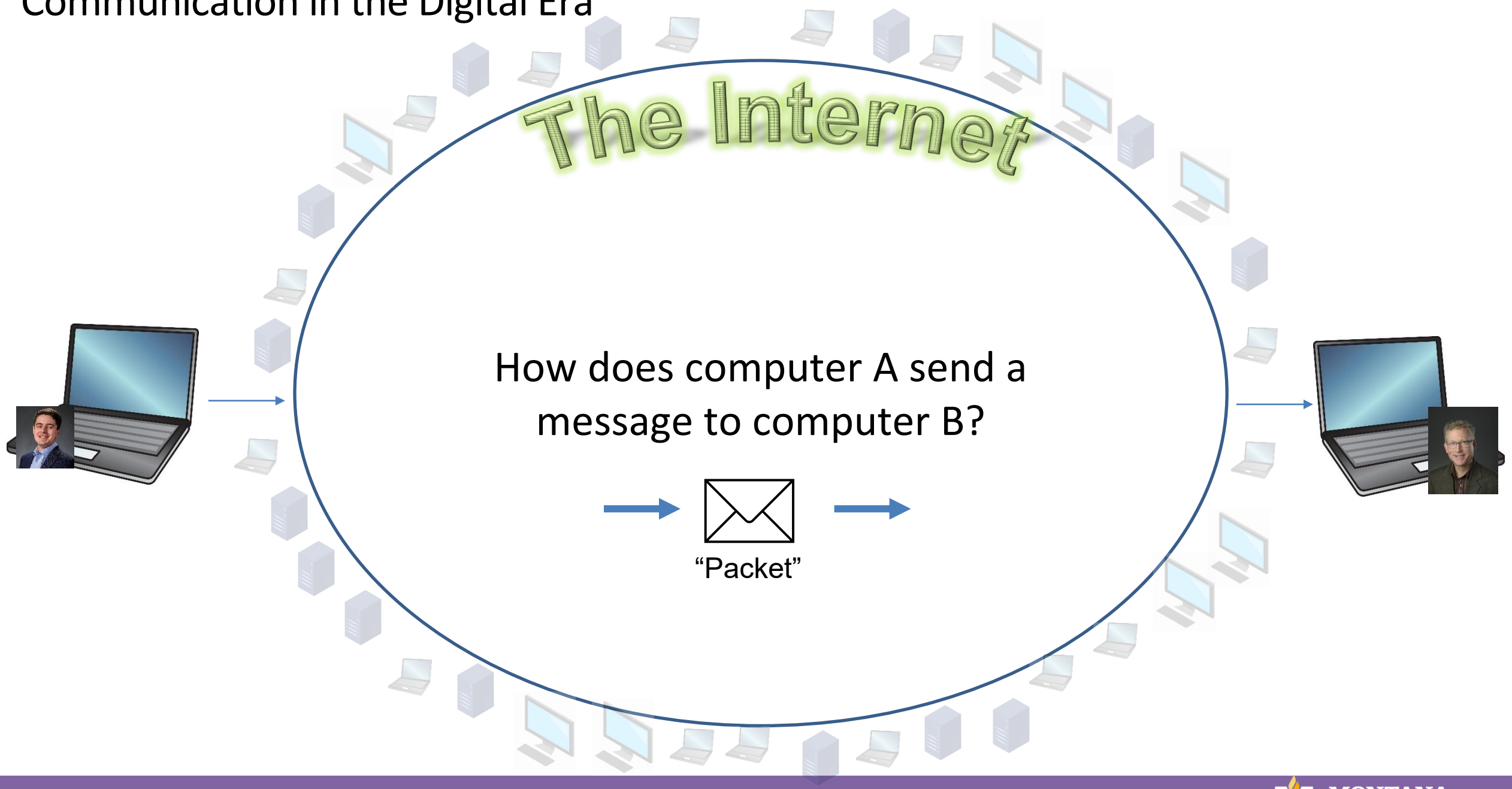

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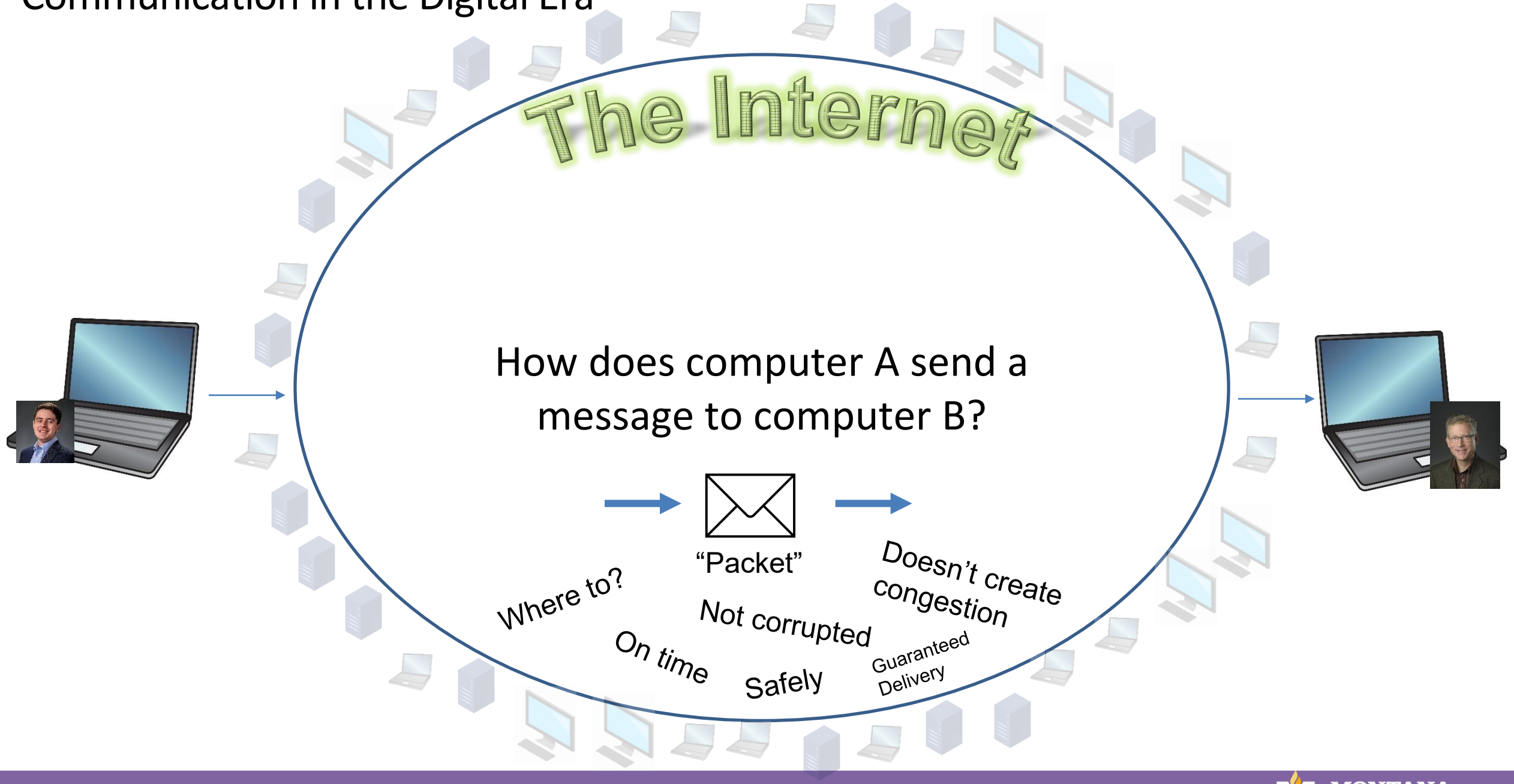

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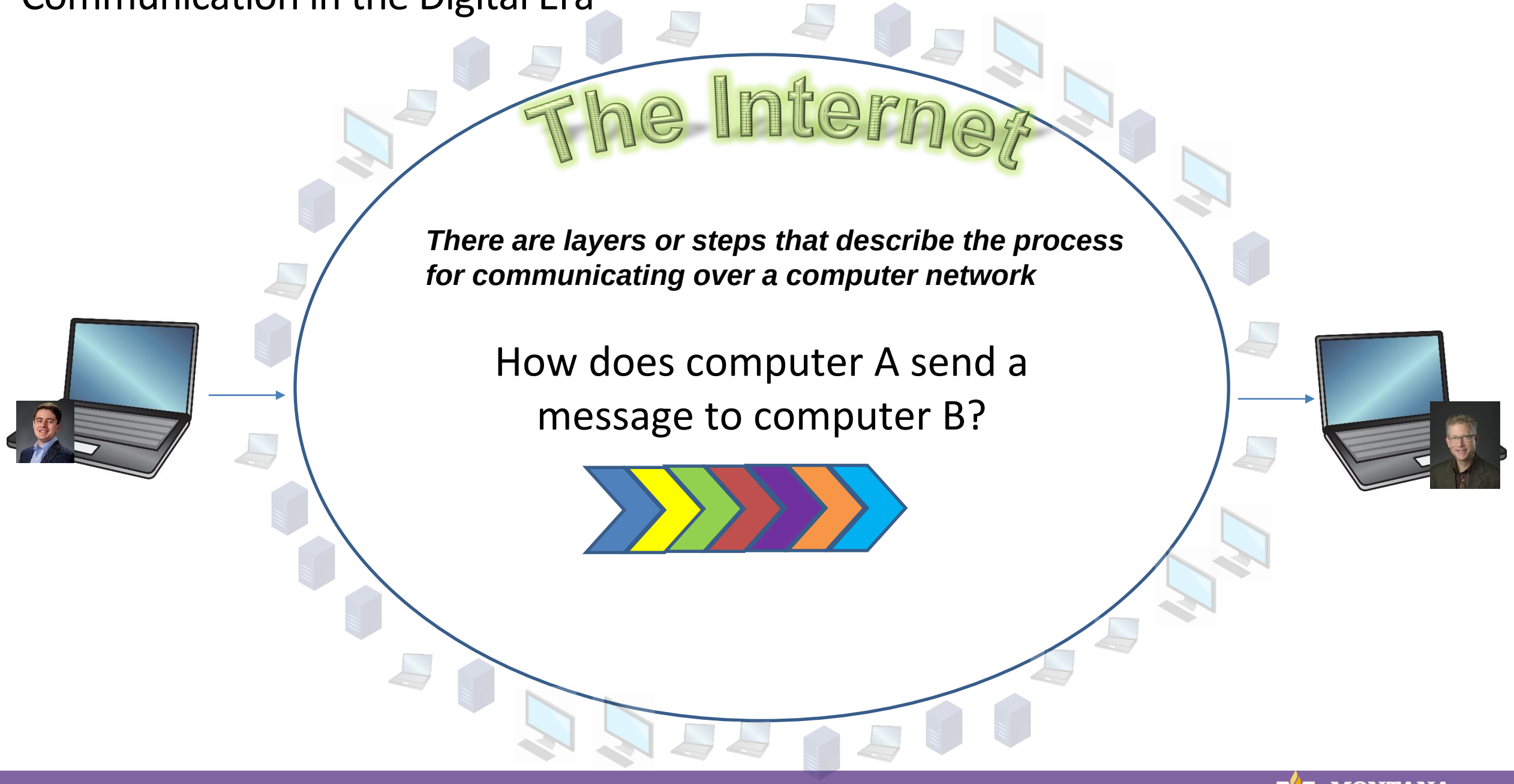

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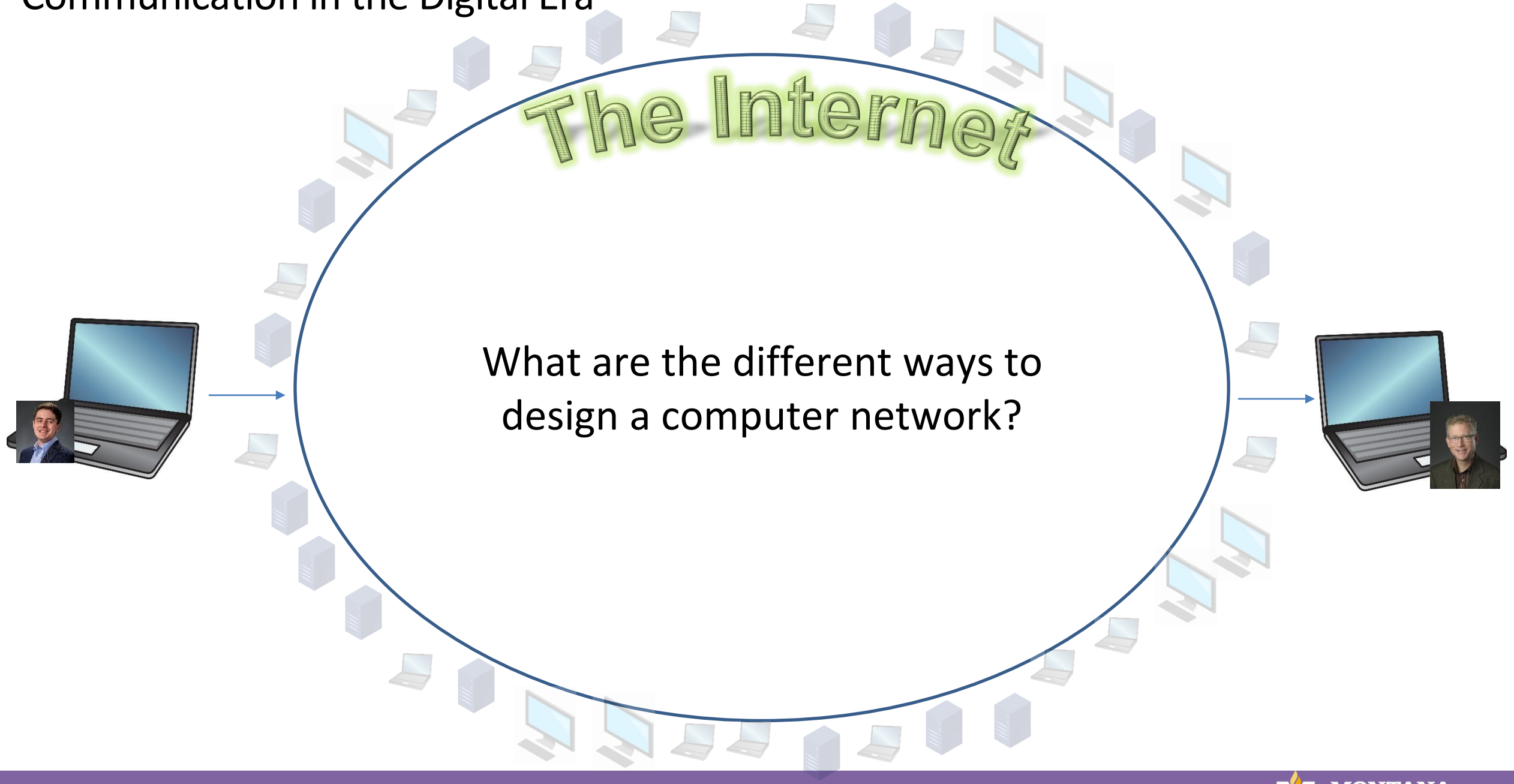

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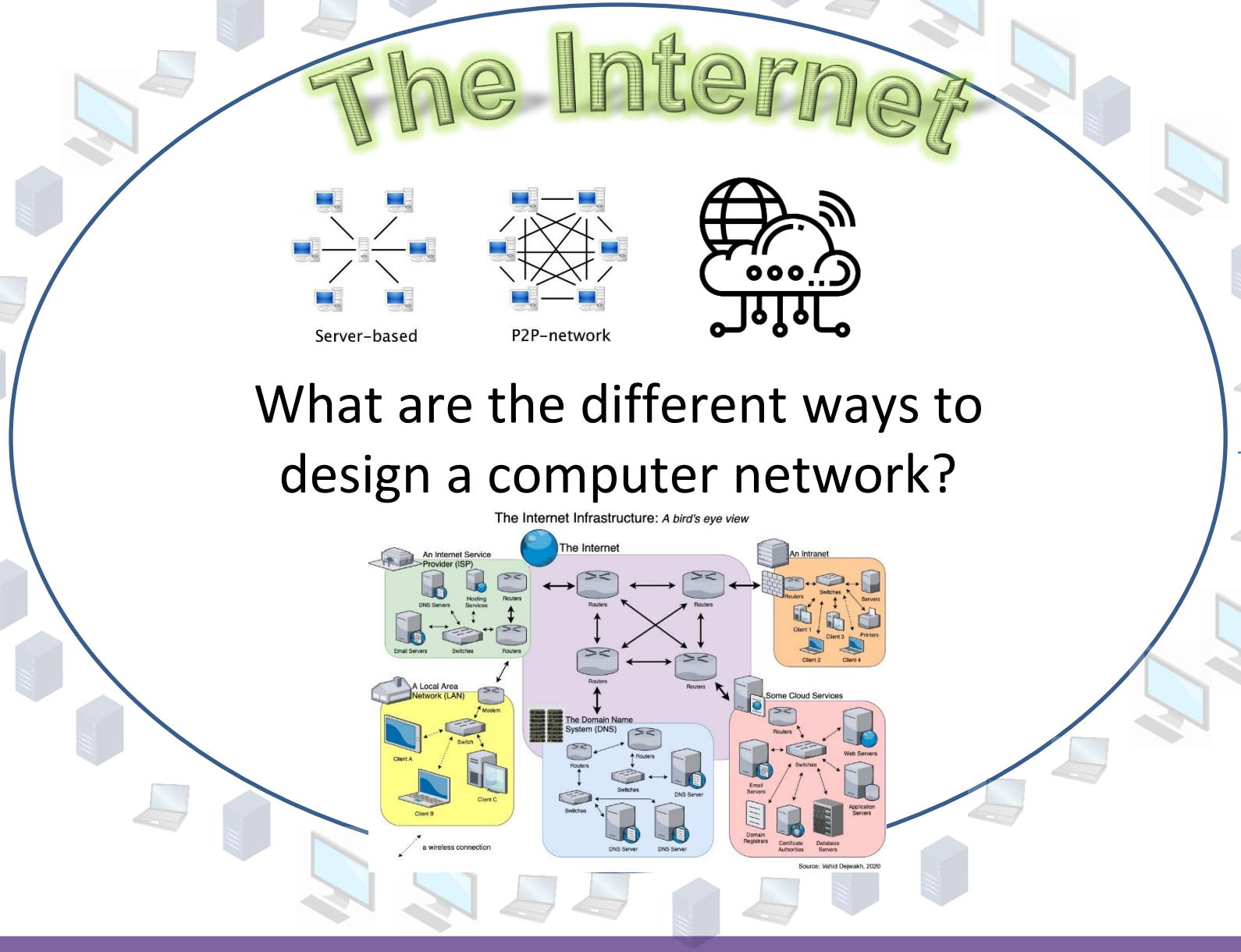

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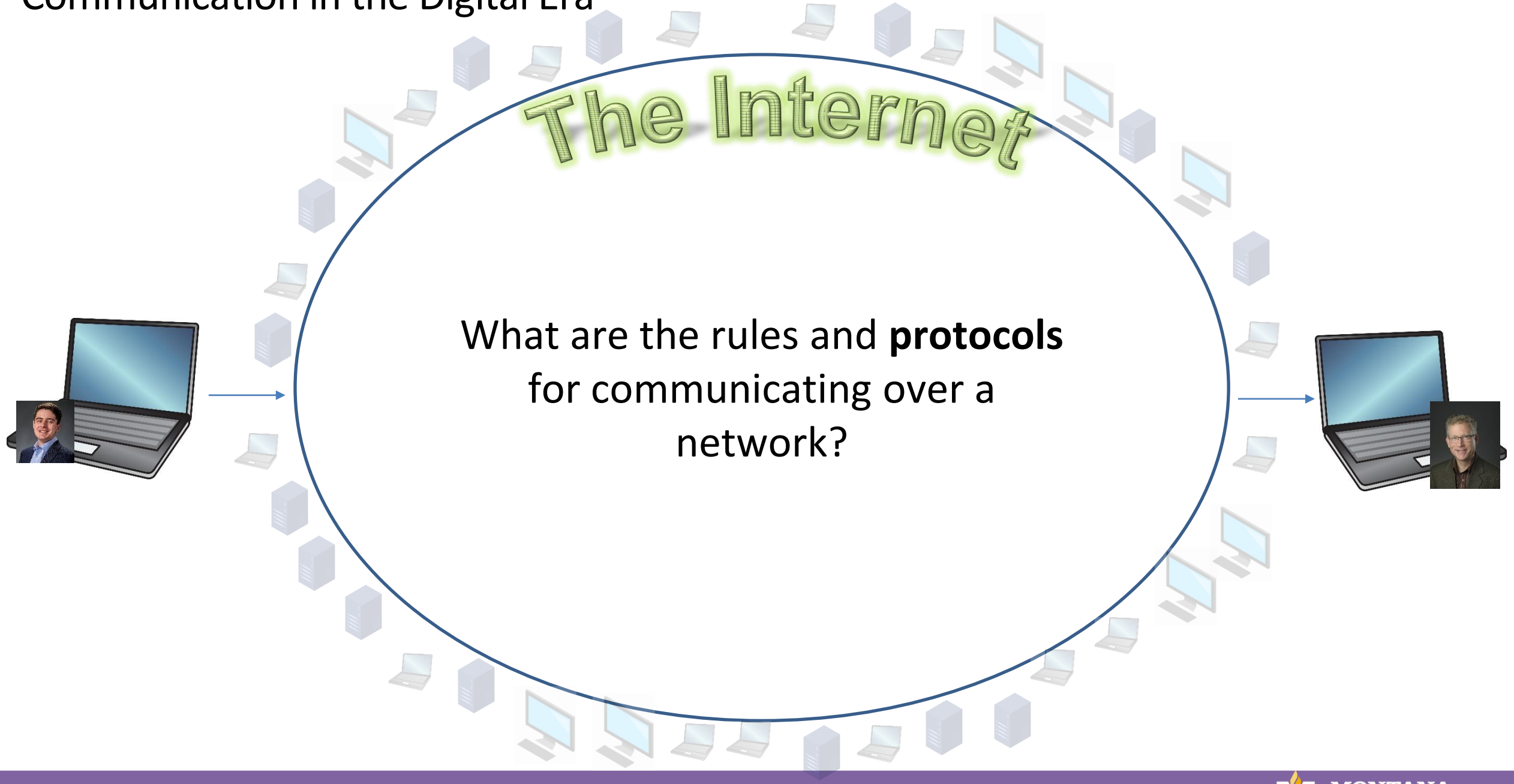

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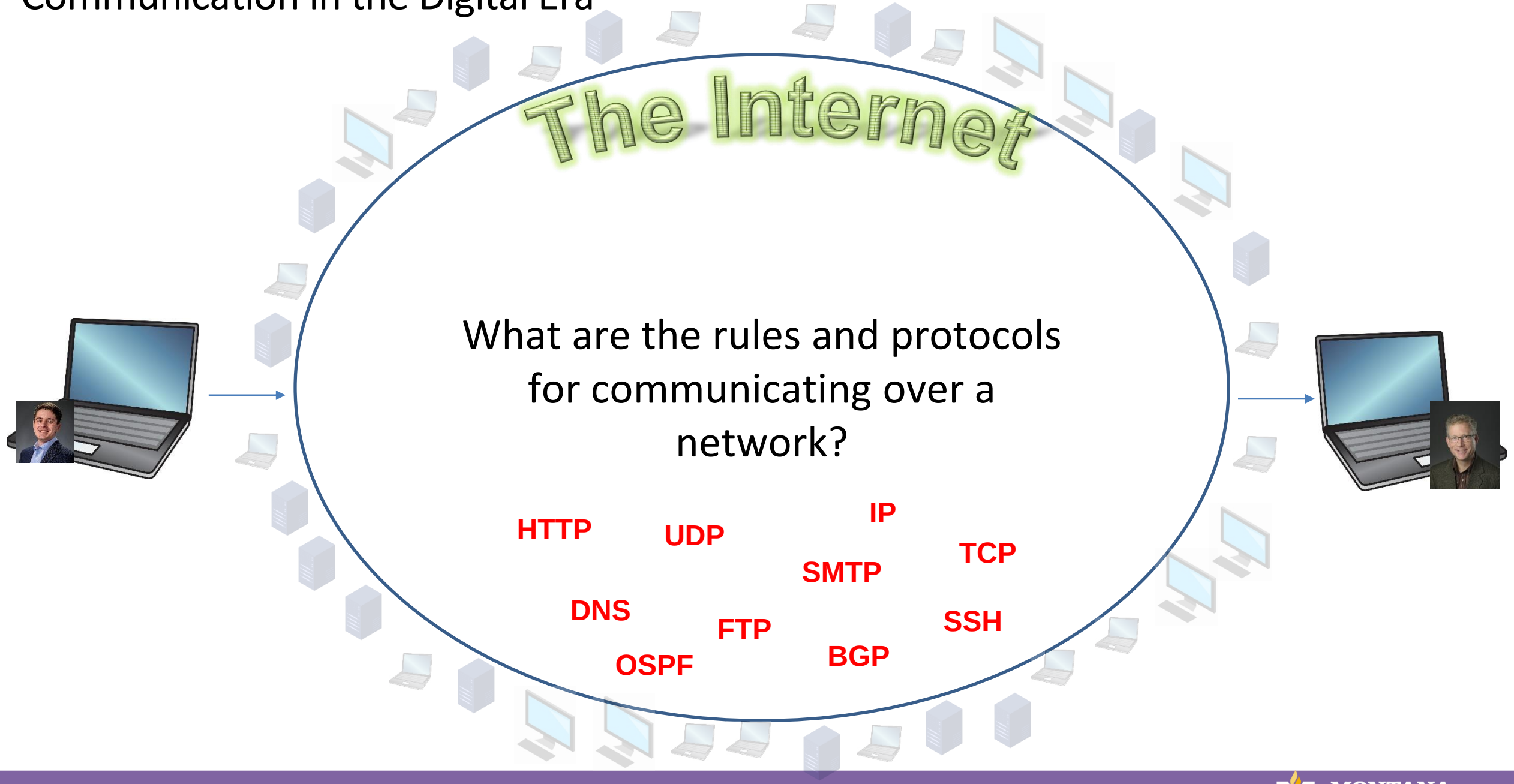

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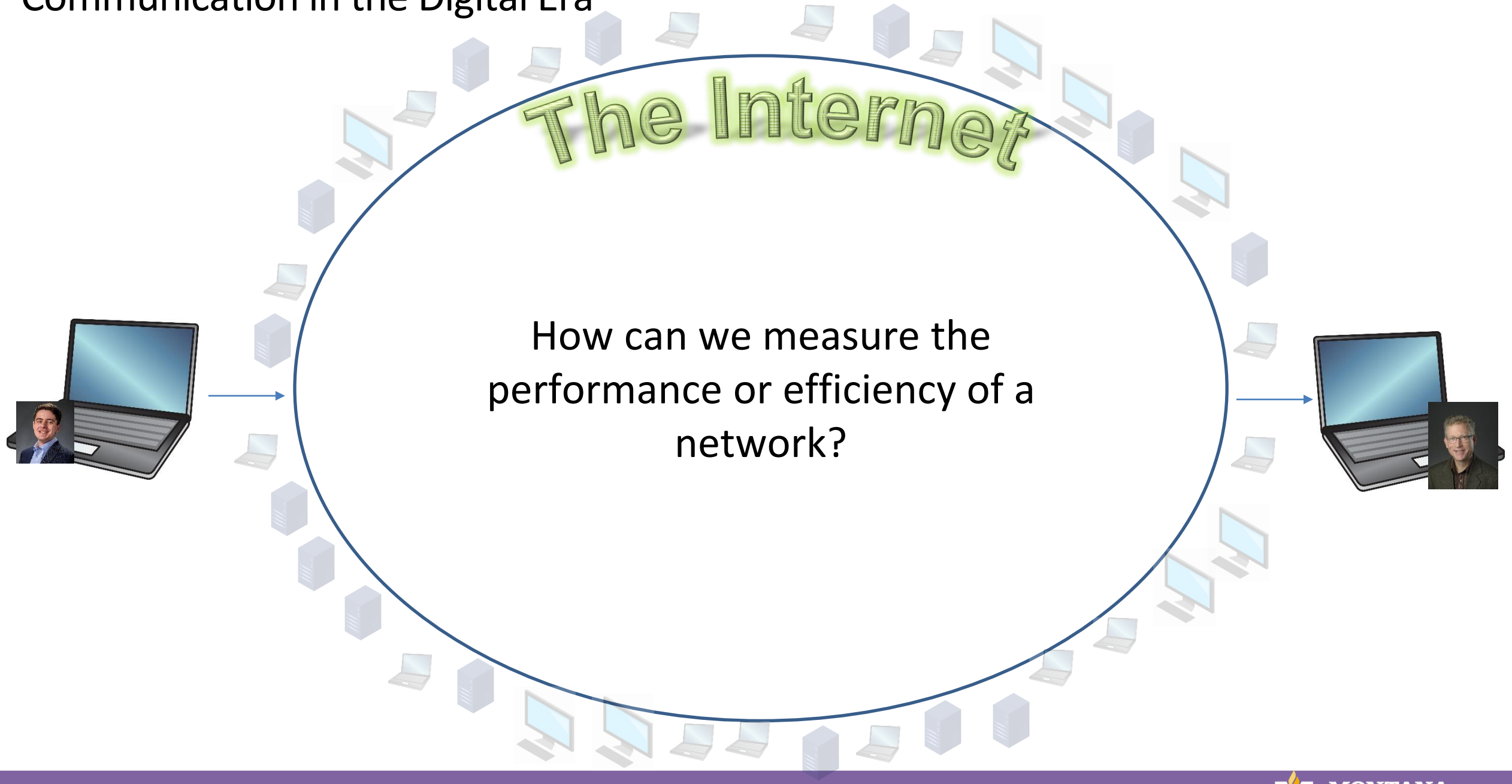


Communication in the Digital Era

The Internet

How can we measure the performance or efficiency of a network?

$$R = \frac{MSS}{RTT}\frac{1.2}{p^{0.5}}$$

- R : Average Throughput
- MSS: Packet Size
- RTT: Round-Trip Time
- P : Packet Loss

– Loss = $8/(3W^2) \Rightarrow W = \sqrt{\frac{8}{3 \cdot Loss}}$ (4)

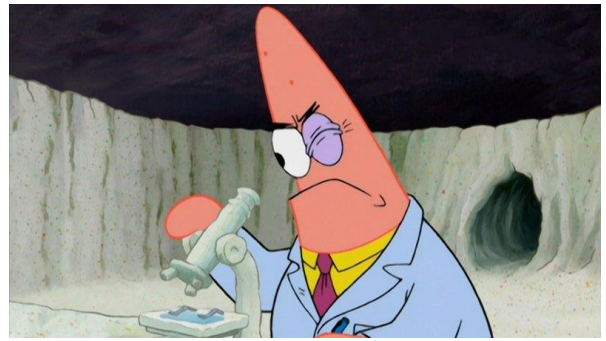
– Substituting (4) in (2), $S = 0.75\ W\ MSS\ /\ RTT$,

Throughput ≈ $1.22 \times \frac{MSS}{RTT \cdot \sqrt{Loss}}$

Communication in the Digital Era

CSCI 466- Course Outcomes

- List the network layers and explain their function in end-to-end communications
- Explain the functions of various Network protocols (HTTP, DNS, TCP/IP, BGP, etc)
- Design and implement network applications
- Analyze network traffic
- Understand important security mechanisms in networks
- Understand what the cloud is and how to implement and deploy a simple cloud application



Reese Pearsall (pierce-all)

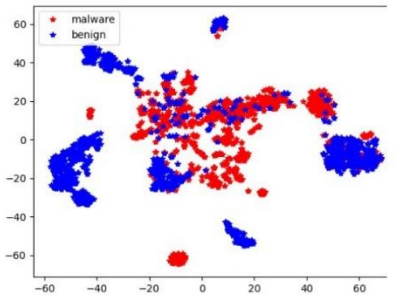
Third year Instructor @MSU
B.S & M.S @ MSU

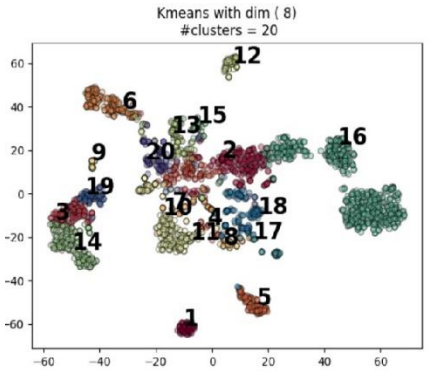
Interests
- Cybersecurity
- Malware analysis and detection
- Cybercrime
- Computer Science Education

Hometown
- Billings, MT

Teaching
- CSCI 132
- CSCI 466
- CSCI 476

Mario Kart Character
- Wario





Experience
- Software Engineer and Tester, Techlink (Bozeman)
- Software Engineer, United States Air Force (Hill AFB, Utah)
- Cybersecurity Software Engineer, Hoplite Industries (Bozeman)
- Graduate Researcher, MSU (Bozeman)

Outside of academia
- Video games, New England Patriots, Fantasy Football, ~~TikTok~~, Garfield, Dr Pepper, Memes, *The Bachelor*, Naps

Contact

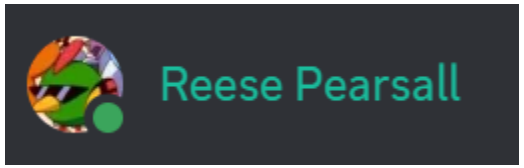
Email: reese.pearsall@montana.edu (I will respond as soon as I can)

Office Hours: Monday, Wednesday, Thursday, Friday 1:00 PM – 2:00 PM

(my office will generally still be open after 2:00)

Office: Barnard Hall 361

I am also very responsive on Discord! (@reese_p)



Logistics

Class Meetings
MWF: 12:00 – 12:50 PM
Norm Asbjornson Hall 137

CSCI 466: Networks

Fall 2024

Date	Topic	Extra Notes	Slides + Lecture Recordings	Assignment
Wednesday August 21st	Syllabus			Please Fill out the Course Questionnaire!
Friday August 23rd	Internet Structure, Data Forwarding			
Monday August 26th	OSI Model, Data Forwarding			
Wednesday August 28th	Network Performance			
Friday August 30th	Application Layer + HTTP			
Monday September 2nd	OFF NO CLASS			
Wednesday September 4th	HTTP Requests, Wireshark			
Friday September 6th	Git, Socket Programming			Quiz 1
Monday September 9th	DNS			
Wednesday September 11th	DNS, SMTP			
Friday September 13th	FTP, P2P, CDNs			Wireshark 1
Monday September 16th	Transport Layer			
Wednesday September 18th	PA1 Work Day (No lecture)			PA1 Due
Friday September 20th	Transport Layer			Quiz 2
Monday September 23rd	Pipelining			
Wednesday September 25th	TCP + UDP			
Friday September 27th	Congestion Control			

Course Website: https://www.cs.montana.edu/pearsall/classes/fall2024/466/main.html

We will be using Discord for class communication and for announcements

Prerequisites

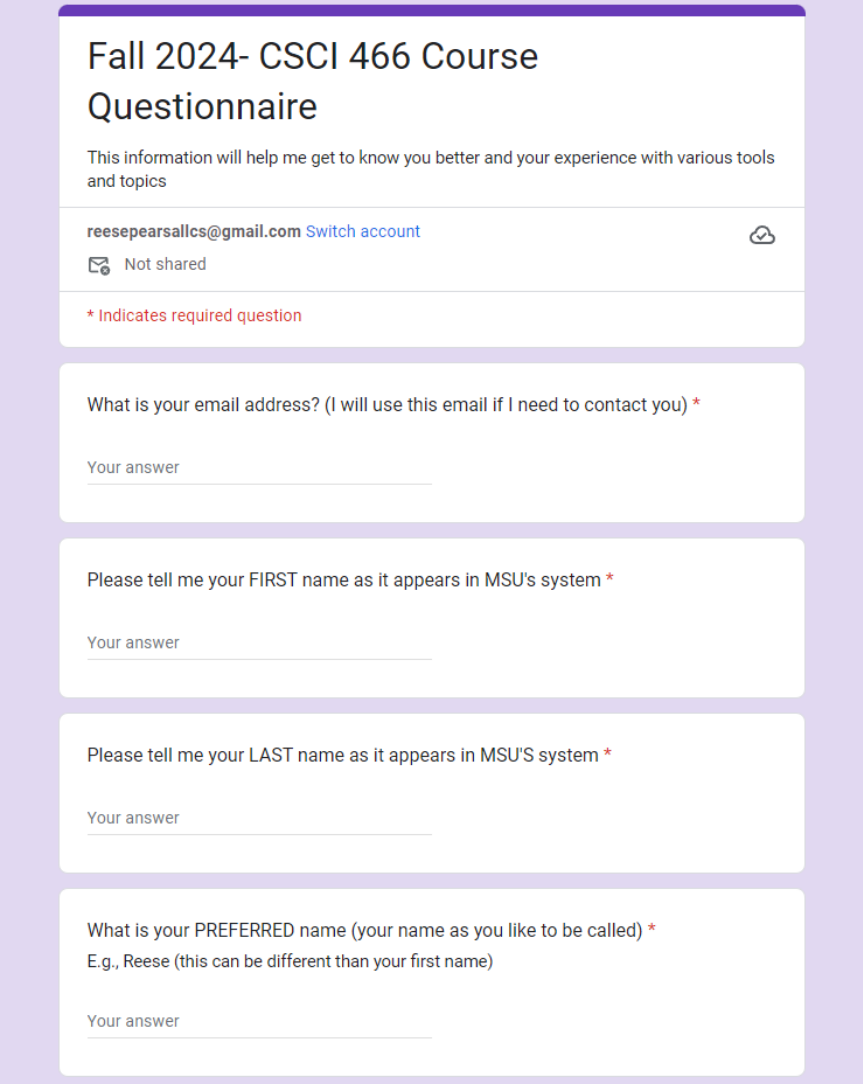
- CSCI 232- Data Structures and Algorithms
- ~~CSCI 112- Programming with C~~
- CSCI 366- Computer Systems (recommended)

Before taking this class, I expect you to be comfortable with:

- Python
- Writing and debugging programs of moderate complexity
- Git & Github (we will likely review this)

Schedule

Course Questionnaire



Fall 2024- CSCI 466 Course Questionnaire

This information will help me get to know you better and your experience with various tools and topics

reesepearsallcs@gmail.com Switch account

Not shared

* Indicates required question

What is your email address? (I will use this email if I need to contact you) *

Your answer

Please tell me your FIRST name as it appears in MSU's system *

Your answer

Please tell me your LAST name as it appears in MSU'S system *

Your answer

What is your PREFERRED name (your name as you like to be called) *

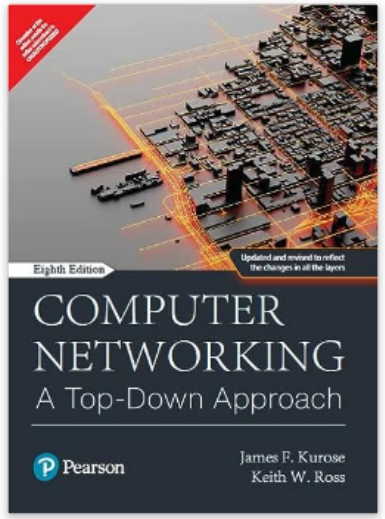
E.g., Reese (this can be different than your first name)

Your answer

Please take some time to do the course questionnaire today or tomorrow

Your answers are important to me, and will help make this class a better experience

Textbook *(optional)*



See all 3 images

Computer Networking: A Top-Down Approach Paperback – January 1, 2022

by James Kurose (Author)

4.5 ★★★★½ 82 ratings **4.1** on Goodreads 2,064 ratings See all formats and editions

The 8th Edition of the popular Computer Networking: A Top Down Approach builds on the authors' long tradition of teaching this complex subject through a layered approach in a "top-down manner." The text works its way from the application layer down toward the physical layer, motivating students by exposing them to important concepts early in their study of networking. Focusing on the Internet and the fundamentally important issues of networking, this text provides an excellent foundation for students in computer science and electrical engineering, without requiring extensive knowledge of programming or mathematics. The 8th Edition has been updated to reflect the most important and exciting recent advances in networking, including software-defined networking (SDN) and the rapid adoption of 4G/5G networks and the mobile applications they enable.

Report incorrect product information.

Reading age	Print length	Dimensions	Publisher	Publication date	ISBN-10
12 years and up	820 pages	7.99 x 10 x 1.85 inches	Pearson India Education Services Private Limited	January 1, 2022	9356061319

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I will **not** require you to get the textbook, but it is a great resource for learning the material and doing the assignments

(currently not in the bookstore)

Cloud Computing

We are going to try to work with Amazon Web Service (AWS) later this semester

Getting a cloud server up and running may cost (a very small) amount of money

Therefore, you may need to have a valid payment option (credit card, etc)

Grading

- **40%** Programming Assignments (5)
- **30%** Wireshark Labs (5)
- **20%** Quizzes (6)
- **10%** Final Quiz

Grading Breakdown

- **40%** Programming Assignments (5)
  - Create network applications using a **language of your choice**
  - Requires a good chunk of your time
  - You will place your assignments in a **private** GitHub repository and submit the repo link to D2L
  - You will record a short video demo showcasing the functionality of your program
  - You are allowed to work with one or two partner(s) (encouraged)

Grading Breakdown

- **30%** Wireshark Labs (5)
  - ➢ Analyze real network traffic and see network concepts and protocols in action
  - ➢ Follow instructions using Wireshark and document your findings and observations in a word document
  - ➢ Submit report to D2L as a PDF
  - ➢ You are allowed to work with one partner (encouraged)

Grading Breakdown

- **20%** Quizzes (6)

➢ Every other week, there will be a quiz on Friday

➢ Tests your knowledge on basic networks concepts we talk about in lecture

➢ Administered via Brightspace (multiple choice, auto-graded)

➢ Quizzes will be open for an 8 hour window, not timed.

➢ I'll drop your lowest quiz grade

➢ Should only take around 15 minutes

Grading Breakdown

- **10%** Final Quiz
  - Only two questions
  - Cumulative quiz that evaluates your knowledge of the entire semester
  - Question 1: You will be asked to document and label the layers and aspects of the OSI model
  - Question 2: Secret
  - Note sheet *not* allowed
  - Will take place on the final class meeting (Dec 6)

Late Assignment Policy

Late Assignment Policy

You will be given 1 virtual late pass. Late passes allow you to submit an program, lab, up to 48 hours late with NO penalty-- no excuse required.

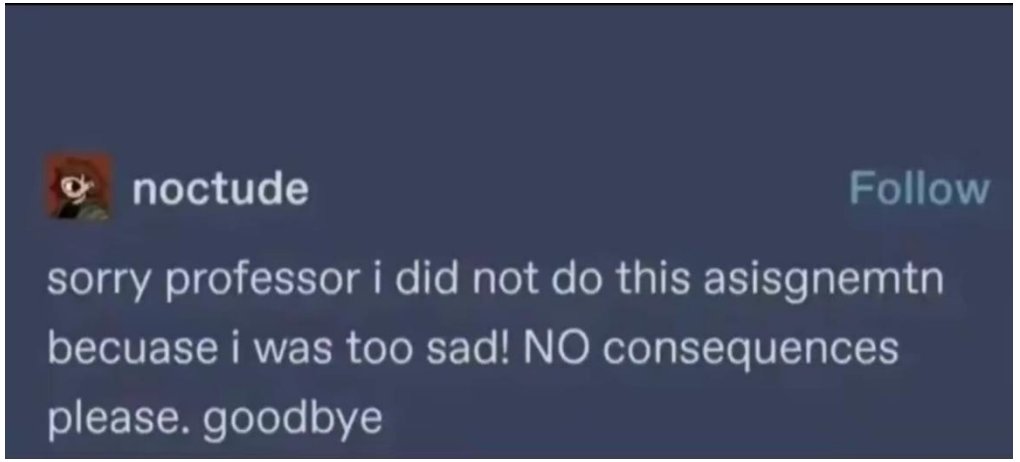
To use a late pass, you must indicate in your submission that you are electing to use a late pass (e.g. in a comment on your submission in D2L).

Note that you cannot change this decision later. You cannot use a late pass on the last programming assignment

If you do not use a late pass, the penalties for late submissions are as follows:

- < 24 hours: 25%
- < 48 Hours 50%
- > 48 hours: no credit.

You get 1 late pass



Grading Scale

- 93+: A
- 90+: A-
- 87+: B+
- 83+: B
- 80+: B-
- 77+: C+
- 73+: C
- 70+: C-
- 67+: D+
- 63: D
- 60: D-

At the end of the semester, if you are within 1% of the next letter grade, I will bump you up

I will not curve assignment or exam grades

Plagiarism, Academic Misconduct, Generative AI tools

Plagiarism and cheating is very not cool

You are **not** allowed to submit something that is not your own, and you are **not** allowed to steal solutions from another person and modify it

I have a Chegg and Course Hero membership. **Don't try it**

Do not use any tools or AI that will write code or solutions for you

Using small snippets of code from the internet is acceptable *(but should not be needed).* If you do use a small snippet of code from the internet, you should leave a reference as a comment in your code

MSU Resources

https://www.cs.montana.edu/pearsall/classes/msu_resources.html

Diversity Statement

Montana State University's campuses are committed to providing an environment that emphasizes the dignity and worth of every member of its community and that is free from harassment and discrimination based upon race, color, religion, national origin, creed, service in the uniformed services (as defined in state and federal law), veteran's status, sex, age, political ideas, marital or family status, pregnancy, physical or mental disability, genetic information, gender identity, gender expression, or sexual orientation. Such an environment is necessary to a healthy learning, working, and living atmosphere because discrimination and harassment undermine human dignity and the positive connection among all people at our University. Acts of discrimination, harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation will be addressed consistent with this policy.

Inclusivity Statement

I support an inclusive learning environment where diversity and individual differences are understood, respected, appreciated, and recognized as a source of strength. We expect that students, faculty, administrators and staff at MSU will respect differences and demonstrate diligence in understanding how other peoples' perspectives, behaviors, and worldviews may be different from their own.

Counseling

In addition to eating right, taking breaks when you need them, and getting enough sleep, you may benefit from talking to a professional counselor if you think stress could be impacting your health. Here is a blurb and some links from MSU's Counseling & Psychological Services: MSU strives to create a culture of support and recognizes that your mental health and wellness are equally as important as your physical health. We want you to know that it's OK if you experience difficulty, and there are several resources on campus to help you succeed emotionally, personally, and academically:

- Counseling & Psychological Services: montana.edu/counseling
- Health Advancement: montana.edu/oha
- Insight Program (Substance Use): montana.edu/oha/insight
- Suicide Prevention: montana.edu/suicide-prevention
- Medical Services: montana.edu/health/medical.html
- WellTrack: montana.welltrack.com/register

Civil Rights

There should be no discrimination or harassment for anyone at MSU. If you notice anything that seems to violate that principle, the Office of Institutional Equity can help. As an employee of MSU, I am a mandatory reporter, which means if I learn of any discrimination or harassment at MSU, I am obligated by my contract to report it.

Hamilton Hall, Offices 114, 116, and 118

How to do well in this class

- Don’t wait until the last night to do an assignment
- Get help when you need it
- Come to class and office hours
- Take care of yourself
- Have fun

Questions?