



KH4065CEM

Intro to Web Development & Database Systems

Lab 1: Terminologies that should not be left unvisited.

Eng. Ahmed Alhallag



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Hello.

This is Ahmed Alhallag.

Been here since the start.

- BSc in Computer & Communication Engineering, MU, 2018
- MSc in Computer Engineering, AASTMT, Present.
- Interests: Cyber-Security, Deep Learning, Internet of Things.



And as a cyber security engineer, you need to know everything.

Agenda

- As a cyber-security specialist, why do I need to be familiar with the CLI & Shell Scripting? **[quick illustration]**
- As a cyber-security specialist, why do I need Programming & Algorithms? **[quick illustration]**
- As a cyber-security specialist, why do I need Computer Networks? Part 1: Recap on Computer Networks (How the internet works)
- **[Mini-brainstorming session]** As a cyber-security specialist, why do I need Computer Networks? Part 2: **2021 Facebook outage analysis**
- Quick Review on CW1: What is a full-stack web application?
- Quick Review on CW1: The Client-Server & 3-tier Architectures
- Software Development Life cycle (SDLC): How to sync **production** environment with **development** environment?
(using **CI/CD**) **[quick illustration]**



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*As a cyber-security specialist, why do I need to be familiar with the **CLI & Shell Scripting**?*

- First of all, what is the CLI? what is shell scripting?

In addition to being able to accept and execute commands interactively, the shell/terminal can also execute commands stored in a file.

```
C:\Users\aalha>cd scirpting  
C:\Users\aalha\scirpting>dir  
Volume in drive C is Windows  
Volume Serial Number is 30A2-63D5  
  
Directory of C:\Users\aalha\scirpting  
  
02/08/2022  02:25 AM    <DIR>          .  
'02/08/2022  02:25 AM    <DIR>          ..  
02/08/2022  01:44 AM           52 cli_cool_tool.sh  
02/08/2022  02:25 AM           81 pyScript.py  
                  2 File(s)        133 bytes  
                  2 Dir(s)   5,909,680,128 bytes free
```

Windows

```
ahmedhallag@DESKTOP-T8FUCMQ ~ /mnt/c/Users/aalha> cd scirpting  
ahmedhallag@DESKTOP-T8FUCMQ ~ /mnt/c/Users/aalha/scirpting> ls  
cli cool_tool.sh pyScript.py
```

Ubuntu

[quick illustration]

- [Extra Materials on Moodle] Recommended Reading: **Getting Familiar with the CLI tutorial**

As a cyber-security specialist, why do I need Shell Scripting?

- Remember how we were able to run python scripts from the terminal? (*from the programming module?*)

pyScript.py



```
print("This is a python script!")
```



```
ahmedhallag@DESKTOP-T8FUCMQ ~ /mnt/c/Users/aalha/scirpting python3 pyScript.py  
This is a python script!
```

- Can we make add a shell command that makes this python file looks like a shell executable command?



```
#!/usr/bin/python
```

- psst: this is called a ***shebang!***



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As a cyber-security specialist, why do I need Programming & Algorithms?

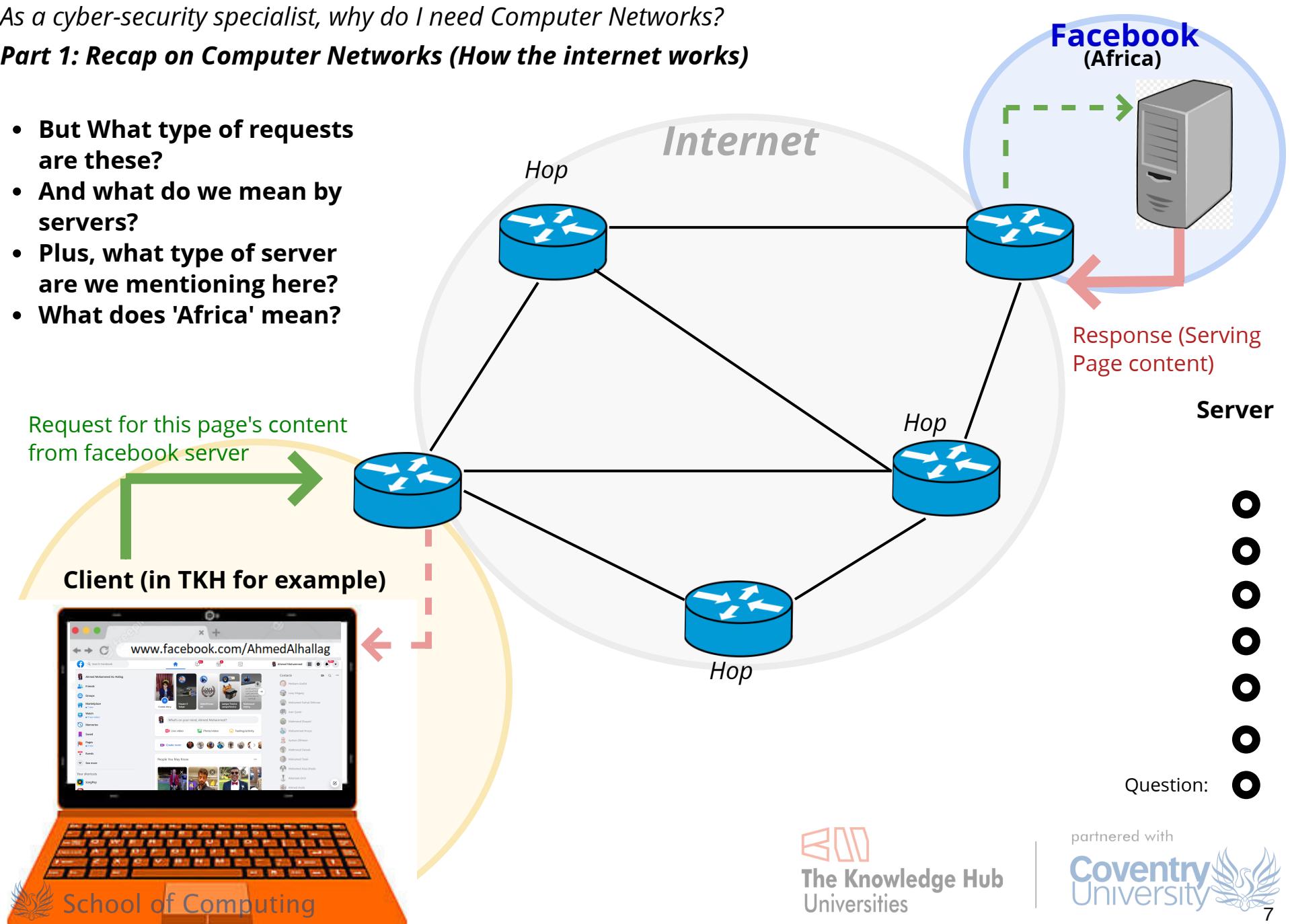
[quick illustration]

Optimization and Efficiency are a must for so many reasons:

1. From a Cyber-Security Specialist Perspective: **When building complex CLI-based applications**
2. From Machine Learning perspective: **Math is everywhere!**

Part 1: Recap on Computer Networks (*How the internet works*)

- But What type of requests are these?
- And what do we mean by servers?
- Plus, what type of server are we mentioning here?
- What does 'Africa' mean?



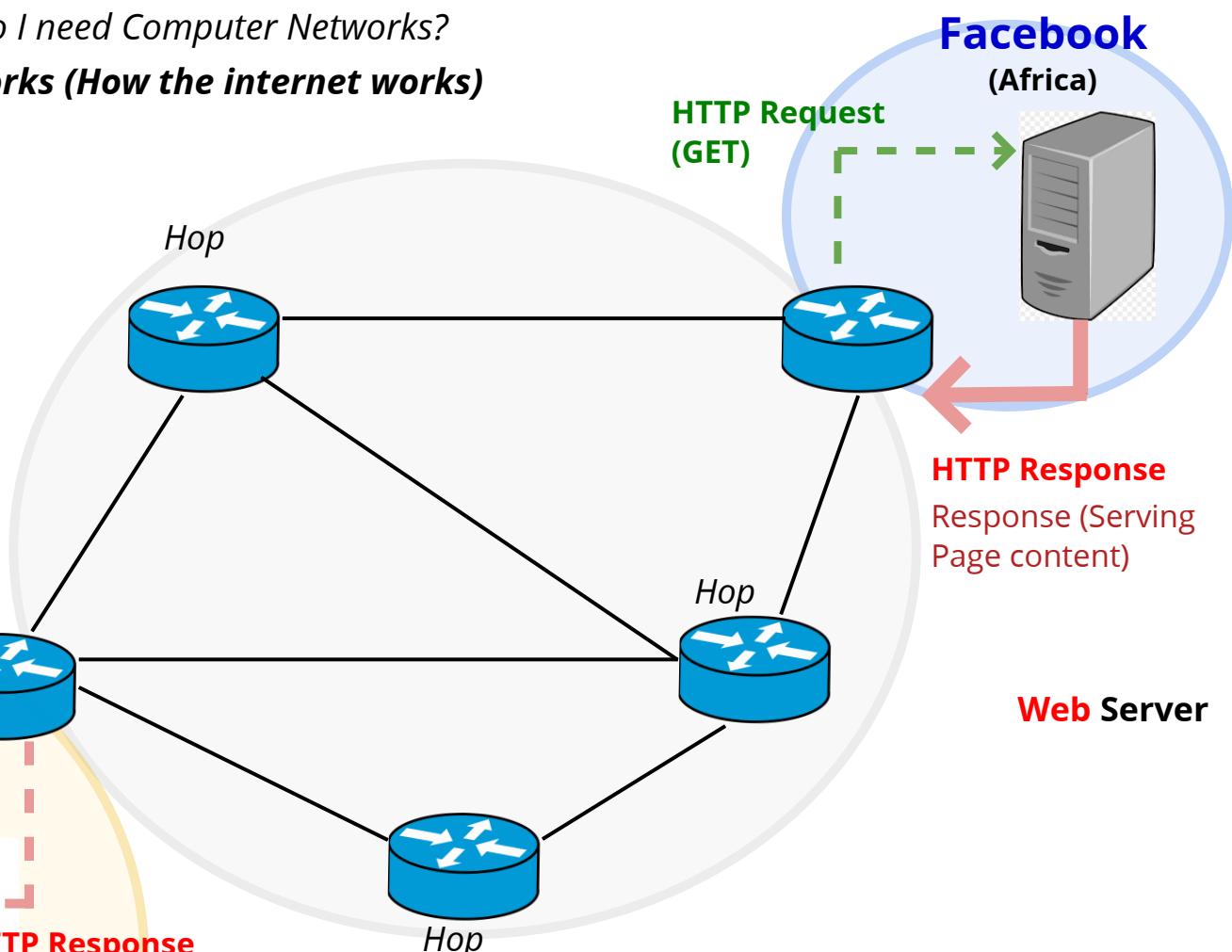
As a cyber-security specialist, why do I need Computer Networks?

Part 1: Recap on Computer Networks (How the internet works)

- But What type of requests are these?
- And what do we mean by servers?
- Plus, what type of server are we mentioning here?
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HTTP Request (GET)

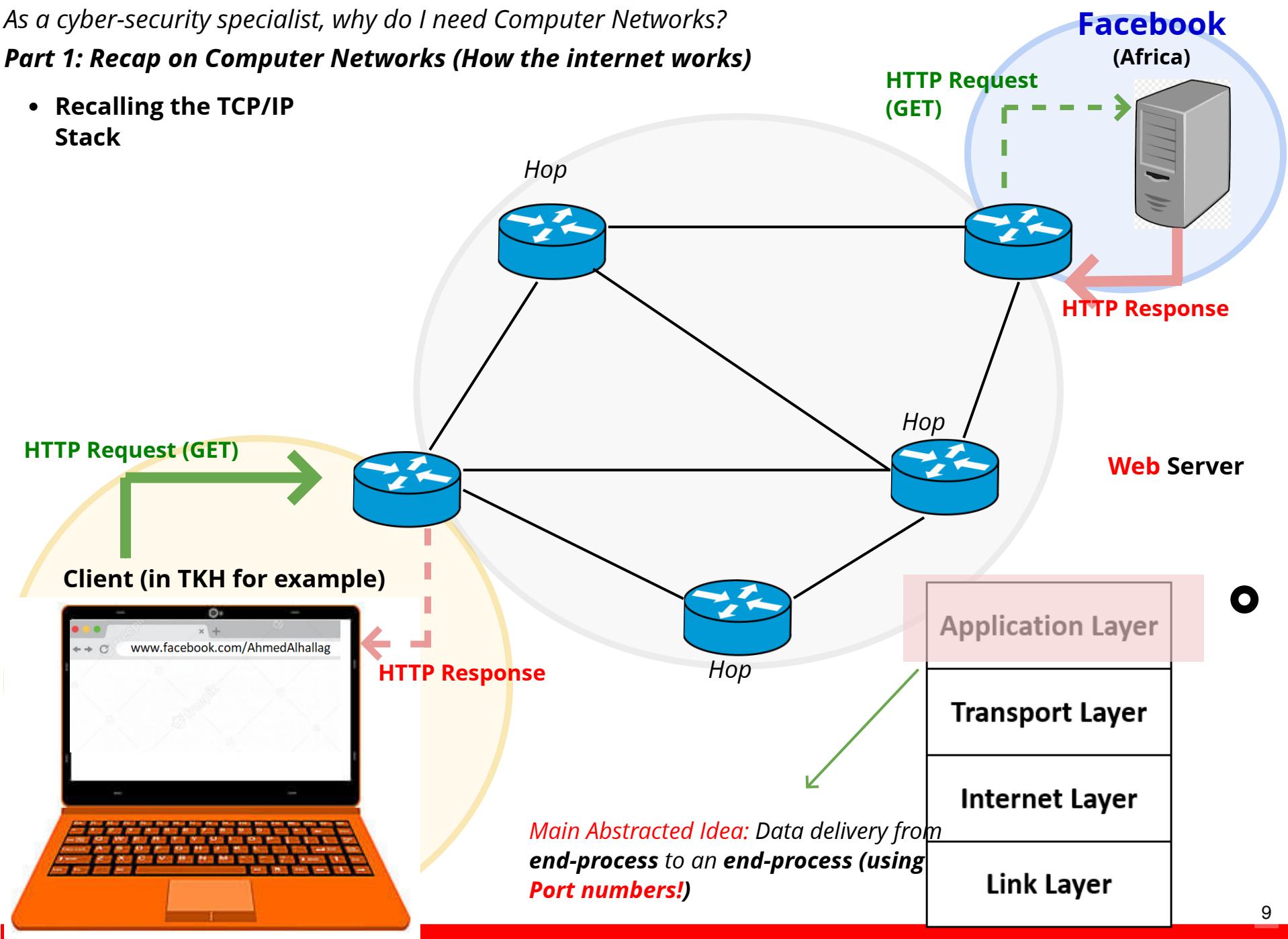
Request for this page's content from facebook server

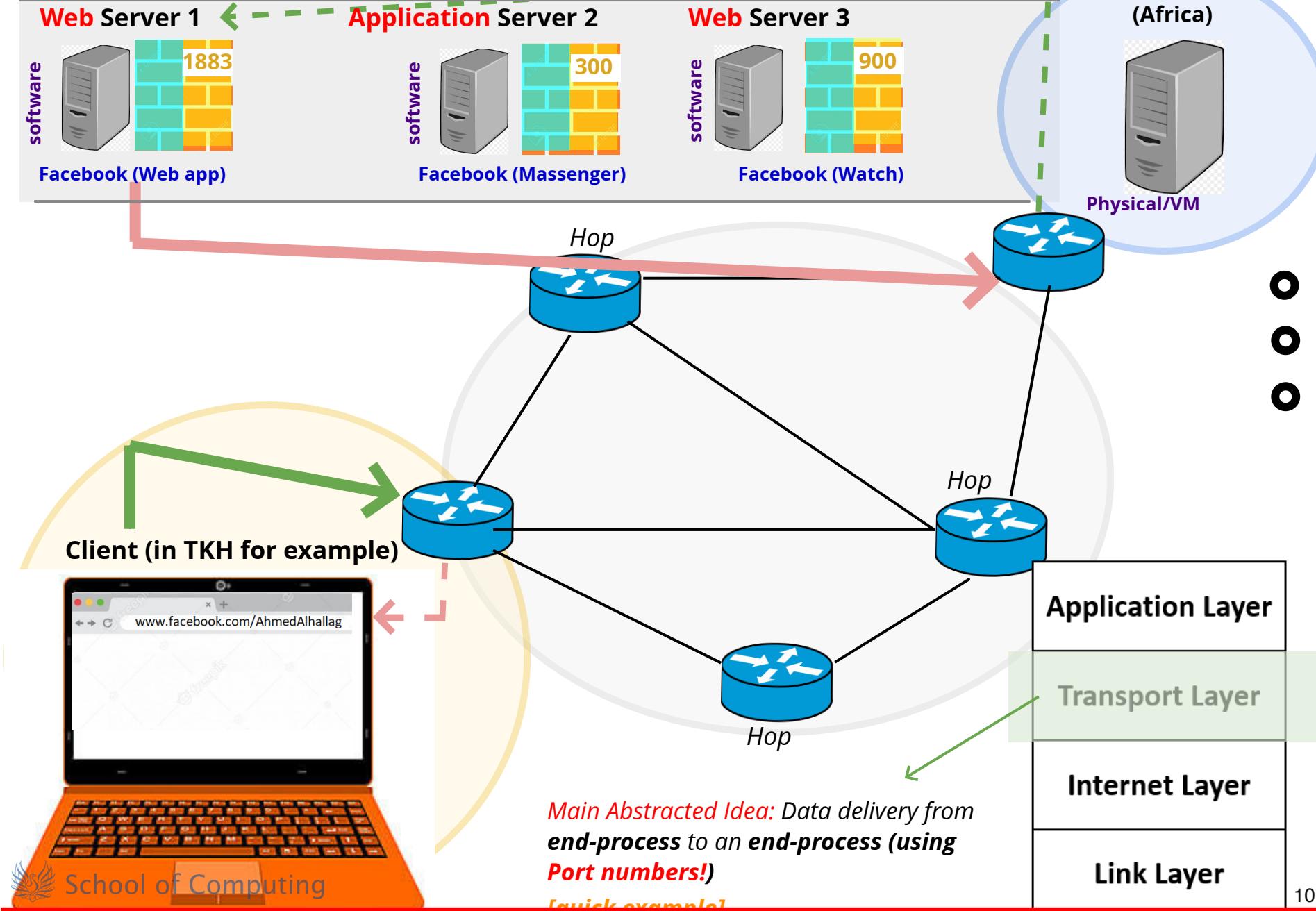


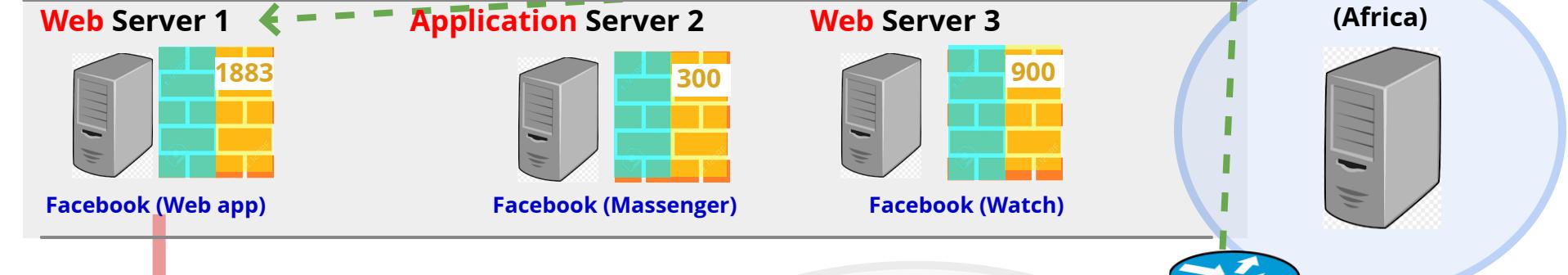
As a cyber-security specialist, why do I need Computer Networks?

Part 1: Recap on Computer Networks (How the internet works)

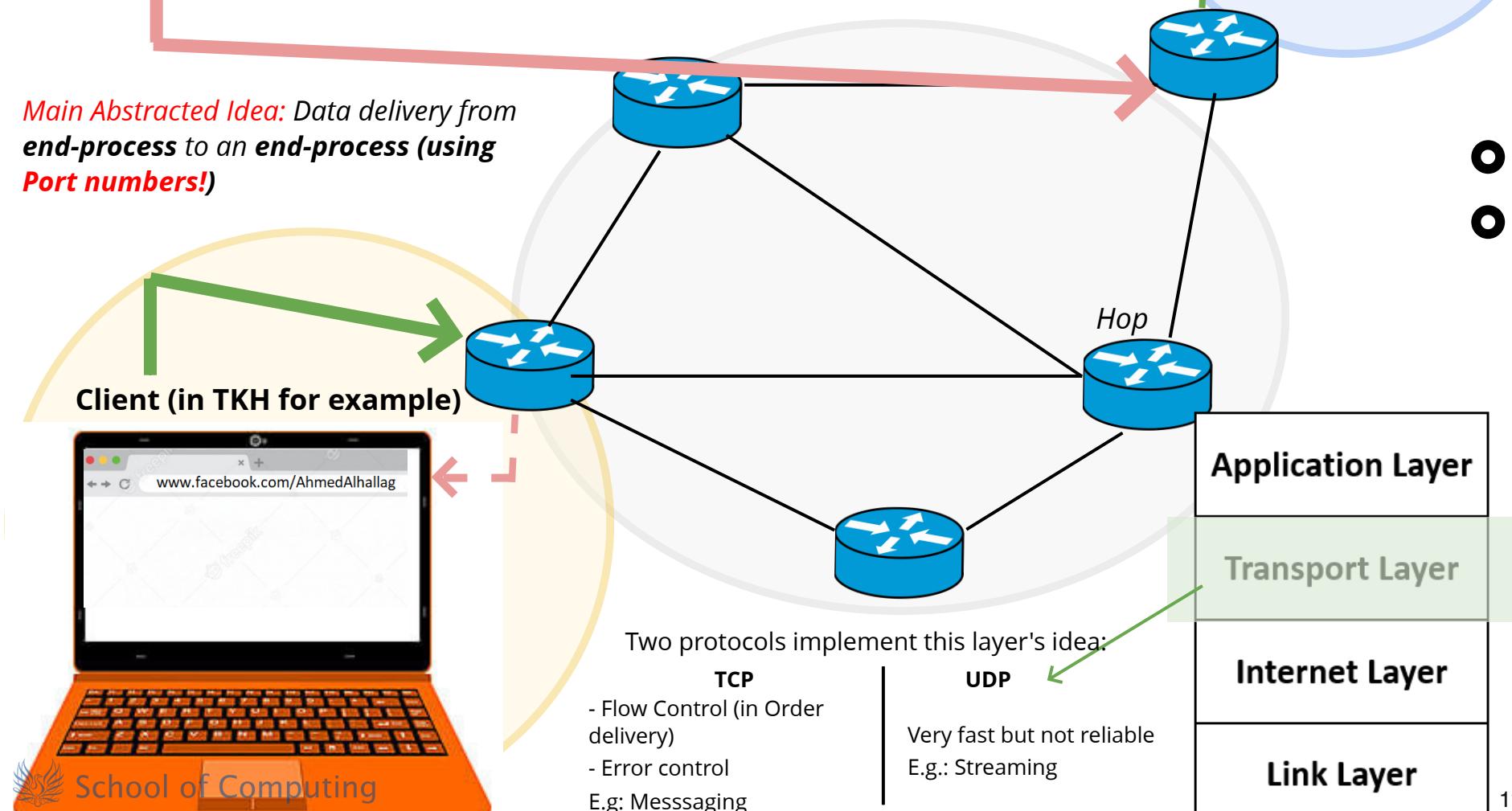
- Recalling the TCP/IP Stack







Main Abstracted Idea: Data delivery from **end-process** to an **end-process** (using Port numbers!)





From Silicon Valley

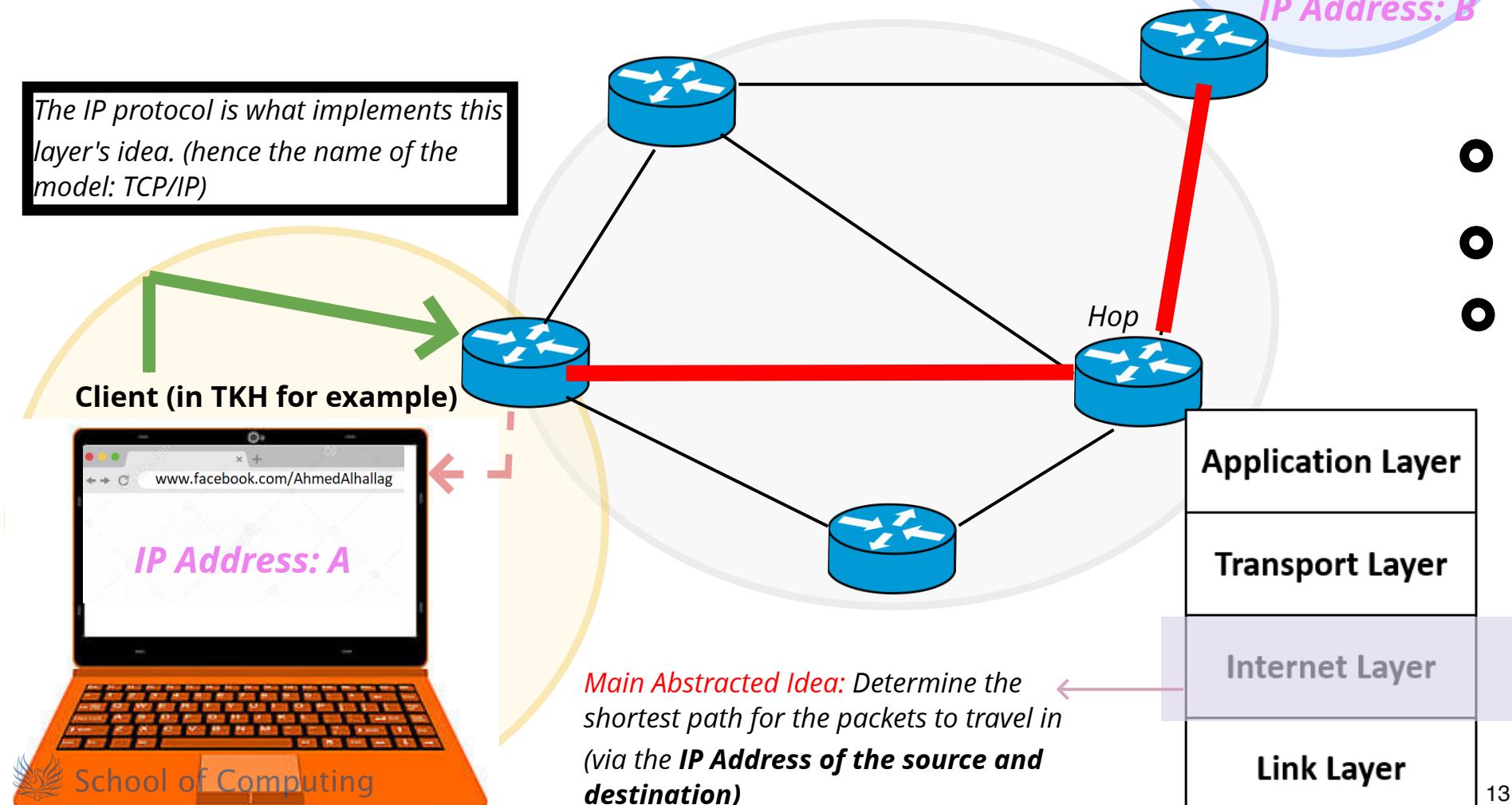
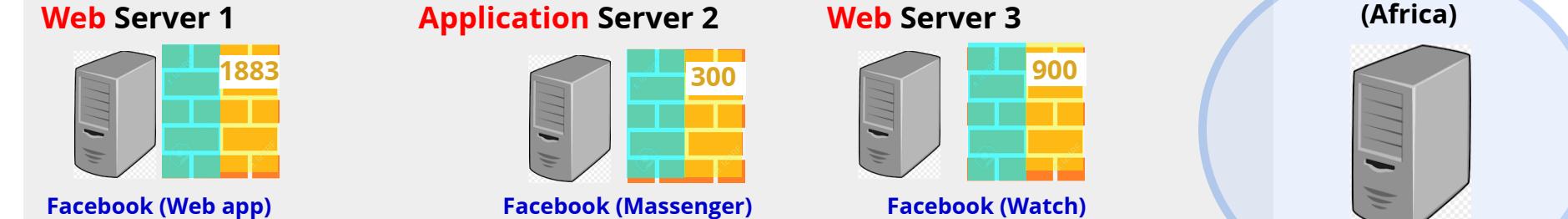
The 4-3 dots scene.

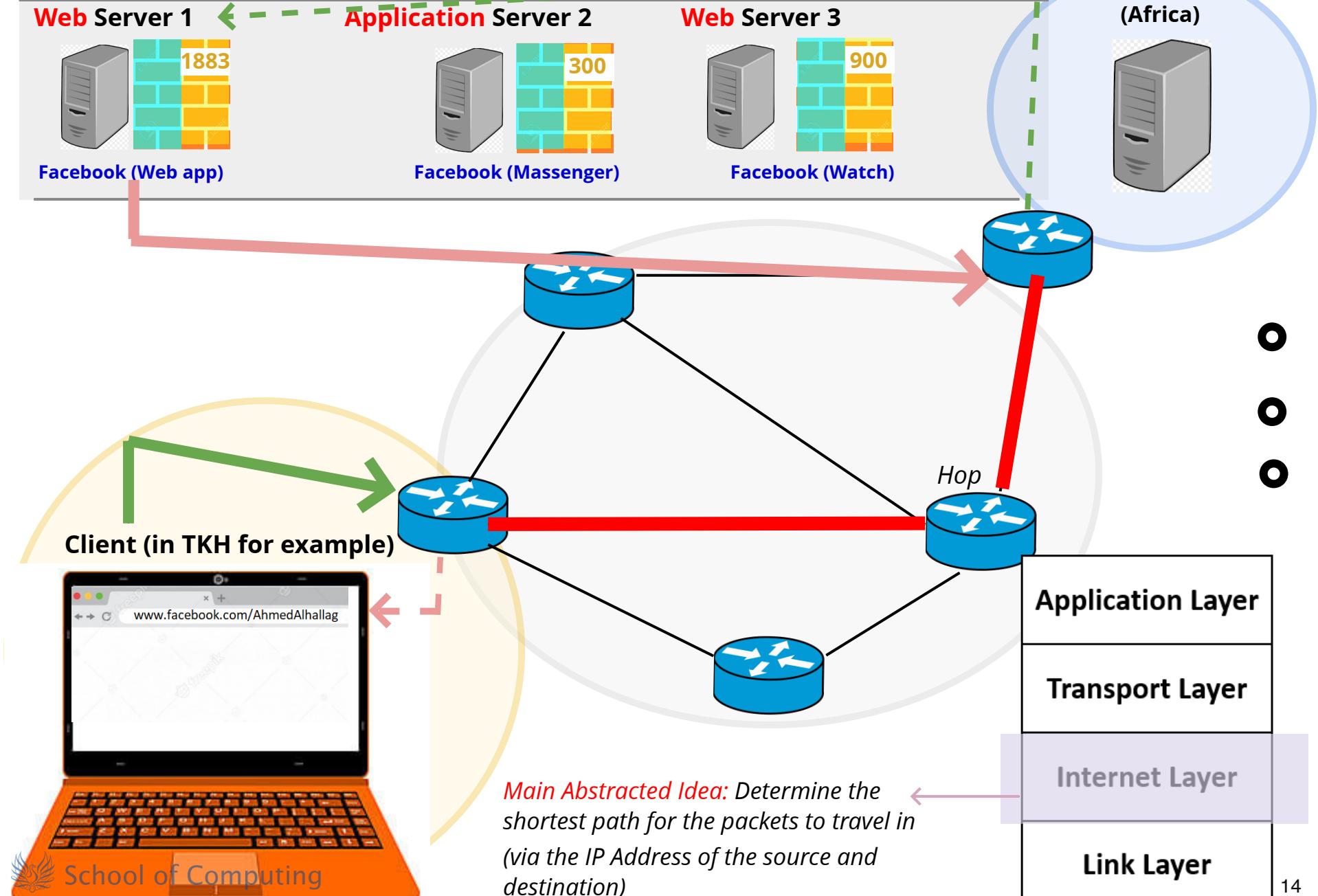
[watch video]

<https://www.youtube.com/watch?v=8k4hdjtqKgY>

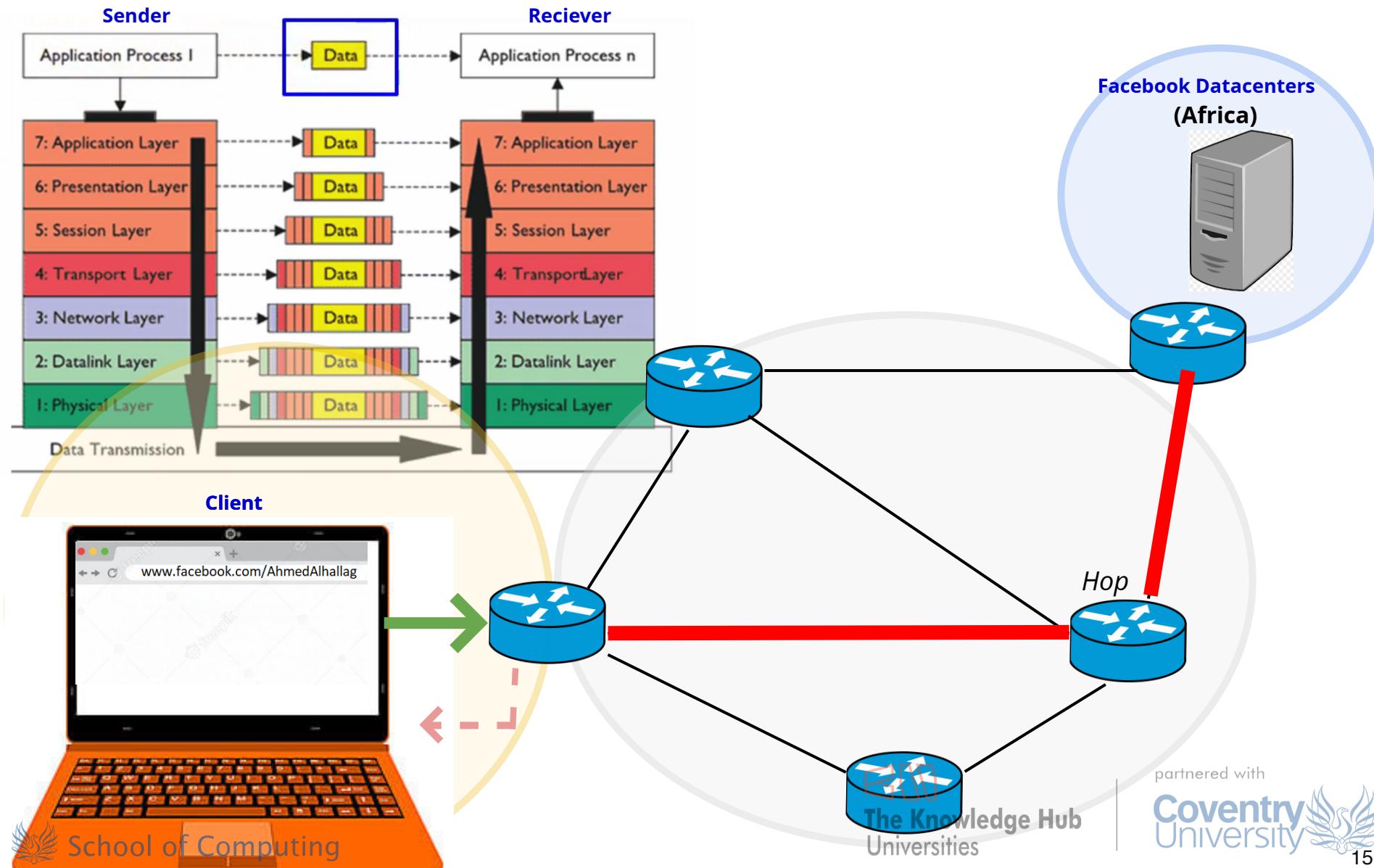
What do you think was the problem there in the transport layer? (flow control? error-control?)







Original Data/Request (payload): "www.facebook.com/AhmedAlhallag"





So Now...

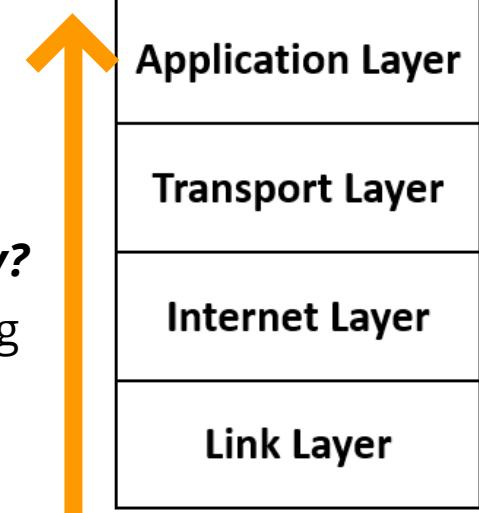
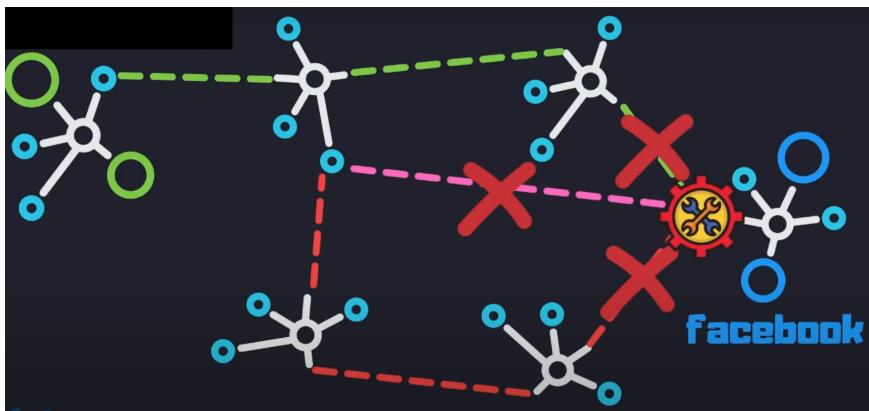
As a cyber-security specialist, (with a strong background in computer networks, and application-level security)..

Given the 2021 Facebook Outage problem statement:

"Facebook's domain disappeared from internet for 6 hours"

Where do you think you should start your diagnostics? and why?

(e.g.: application level issues (bugs, sql injections, remote loading like the log4j) ? transport level security issues? Network layer security issues?)



recall the decapsulation routine while answering, that happens at the receiver side (facebook datacenters)



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Quick Review on CW1: A full-stack web app.

What are full stack applications? The Front-end and the Back-end

What are full stack applications? The Front-end and the Back-end

- Full stack technology refers to the **entire depth** of a computer system **application**, and full stack developers straddle two separate development domains: the **front-end** and the **back-end**.

The Kitchen and Front-of-house Analogy



So .. who is the front-end and whose the back-end?

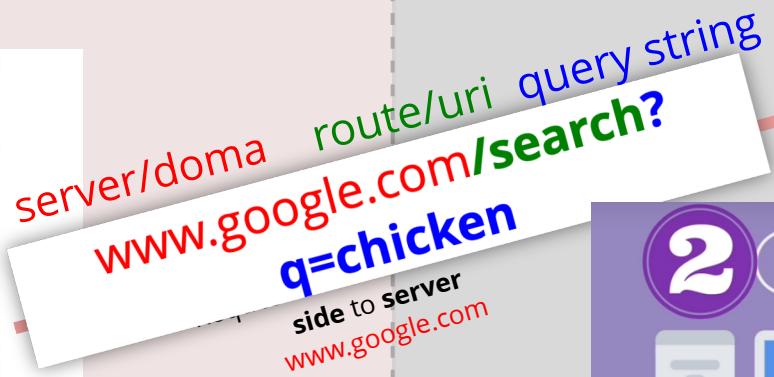
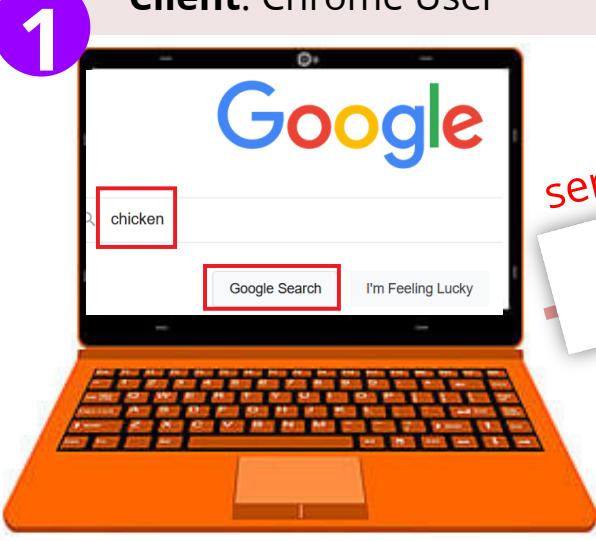
What are full stack applications? The Front-end and the Back-end

[Front-end]

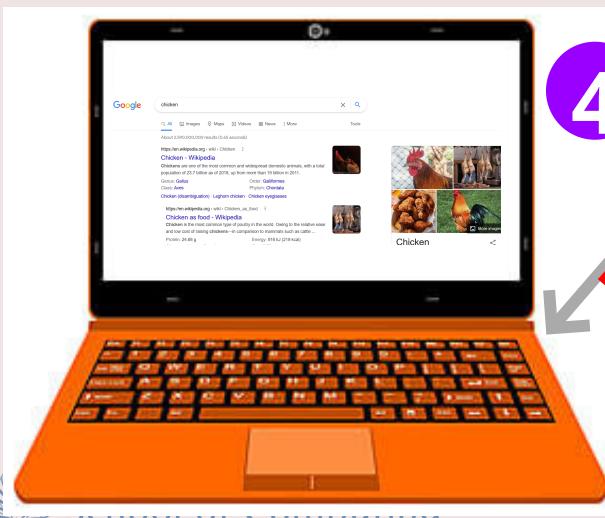
[Back-end/Server-side]

(including databases and third party services or APIs)

Client: Chrome User



Alot of **Logic** is performed on the server-side (on google servers)



What are full stack applications? The Front-end and the Back-end

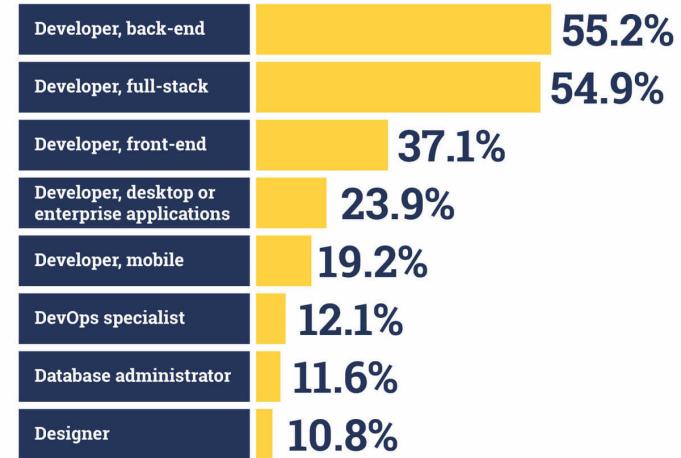
Another Example:

[Demo] A code-pen **calculator**:

<https://codepen.io/giana/pen/GJMBEv>

How Developers Identify Their Roles

What percentage of developers identify as full stack, front end, and back end?



StackOverflow, "2020 Developer Survey," (2020)
<https://insights.stackoverflow.com/survey/2020#developer-roles>

To summarize:

Front-end

1. How things look
2. Images, content, structure
3. HTML, CSS, JavaScript

Back-end

1. How things work
2. Logic & data
3. Ruby, Python, PHP, Java, etc



- **You will be working on both ends (full stack).**

So logic resides on the server-side or the back-end, but what **Logic** specifically means?



What are full stack applications? The Front-end and the Back-end

*So logic resides on the server-side or the back-end,
but what **Logic** specifically means?*

Processing/Application Logic

- Generally any code containing **control structures (if statements, for loops, etc..)** written by any programming language.
- What gets passed-through, from a function to the other, or the way data is received from a table in a database for example in a certain structure, and how to convert it/format it later on.
- It would not relate to the business or the end-user directly, but it must be written by the developer.
 - [Demo]

Blog App: JSON response vs Rendered Response

Business Logic

- Logic written to satisfy **business related use-cases/user stories**: login, register, booking, view courses, enroll to course, view results, etc..
- e.g.: "As a logged in user, I want to have my results displayed after I finish my online attempt"

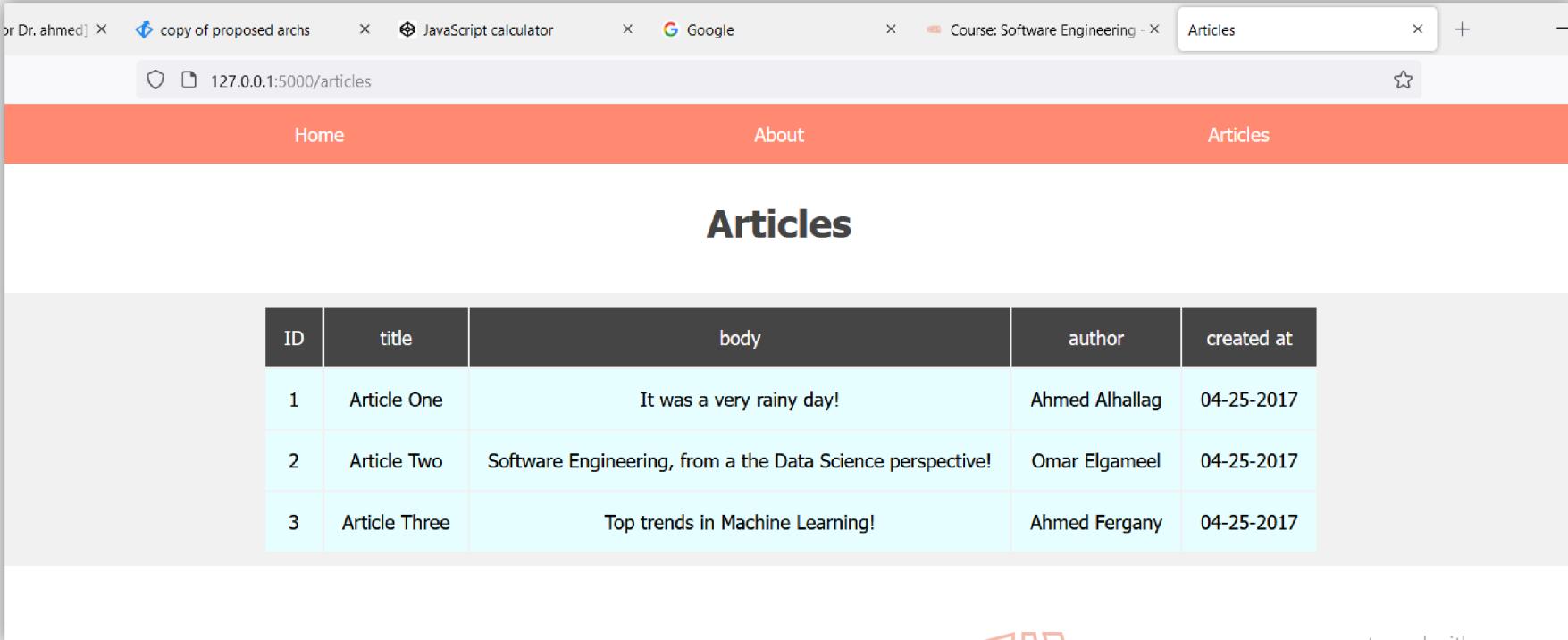


What are full stack applications? The Front-end and the Back-end

So logic resides on the server-side or the back-end, but what **Logic** specifically means?

Processing/Application Logic

- Example:
- In a **Blog** application the **expected** (*human-readable*) view/format that the end user should see when he asks for his **articles** should be as follows:



The screenshot shows a web browser window with multiple tabs open. The active tab is titled "Articles" and displays a list of three articles. The page has a header with "Home", "About", and "Articles" links. The main content area is titled "Articles" and contains a table with three rows of data.

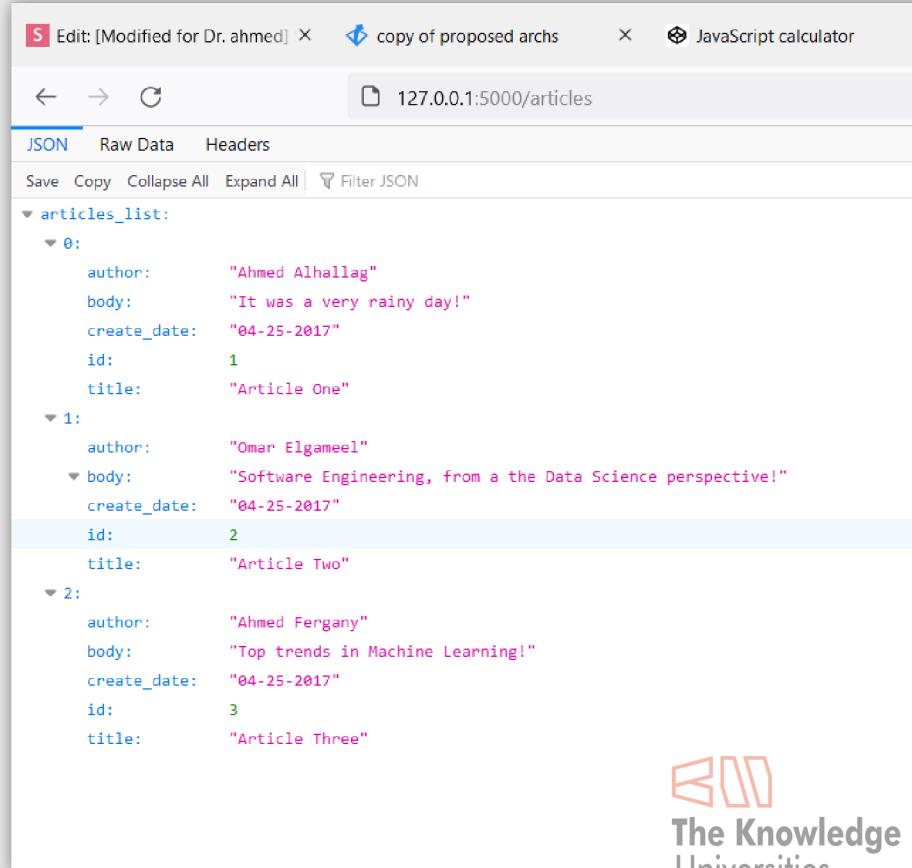
ID	title	body	author	created at
1	Article One	It was a very rainy day!	Ahmed Alhallag	04-25-2017
2	Article Two	Software Engineering, from a the Data Science perspective!	Omar Elgamel	04-25-2017
3	Article Three	Top trends in Machine Learning!	Ahmed Fergany	04-25-2017

What are full stack applications? The Front-end and the Back-end

So logic resides on the server-side or the back-end, but what **Logic** specifically means?

Processing/Application Logic

- Not in a **JSON** format (or any other programming based data structure, which is completely weird to the end user!)



The screenshot shows a browser developer tools JSON viewer with the URL `127.0.0.1:5000/articles`. The JSON data is as follows:

```
articles_list:
  0:
    author: "Ahmed Alhallag"
    body: "It was a very rainy day!"
    create_date: "04-25-2017"
    id: 1
    title: "Article One"
  1:
    author: "Omar Elgamel"
    body: "Software Engineering, from a the Data Science perspective!"
    create_date: "04-25-2017"
    id: 2
    title: "Article Two"
  2:
    author: "Ahmed Fergany"
    body: "Top trends in Machine Learning!"
    create_date: "04-25-2017"
    id: 3
    title: "Article Three"
```

The Client-Server & the 3-tier Architectural Patterns

(Quick Review on CW1)

CRUD

C: Create

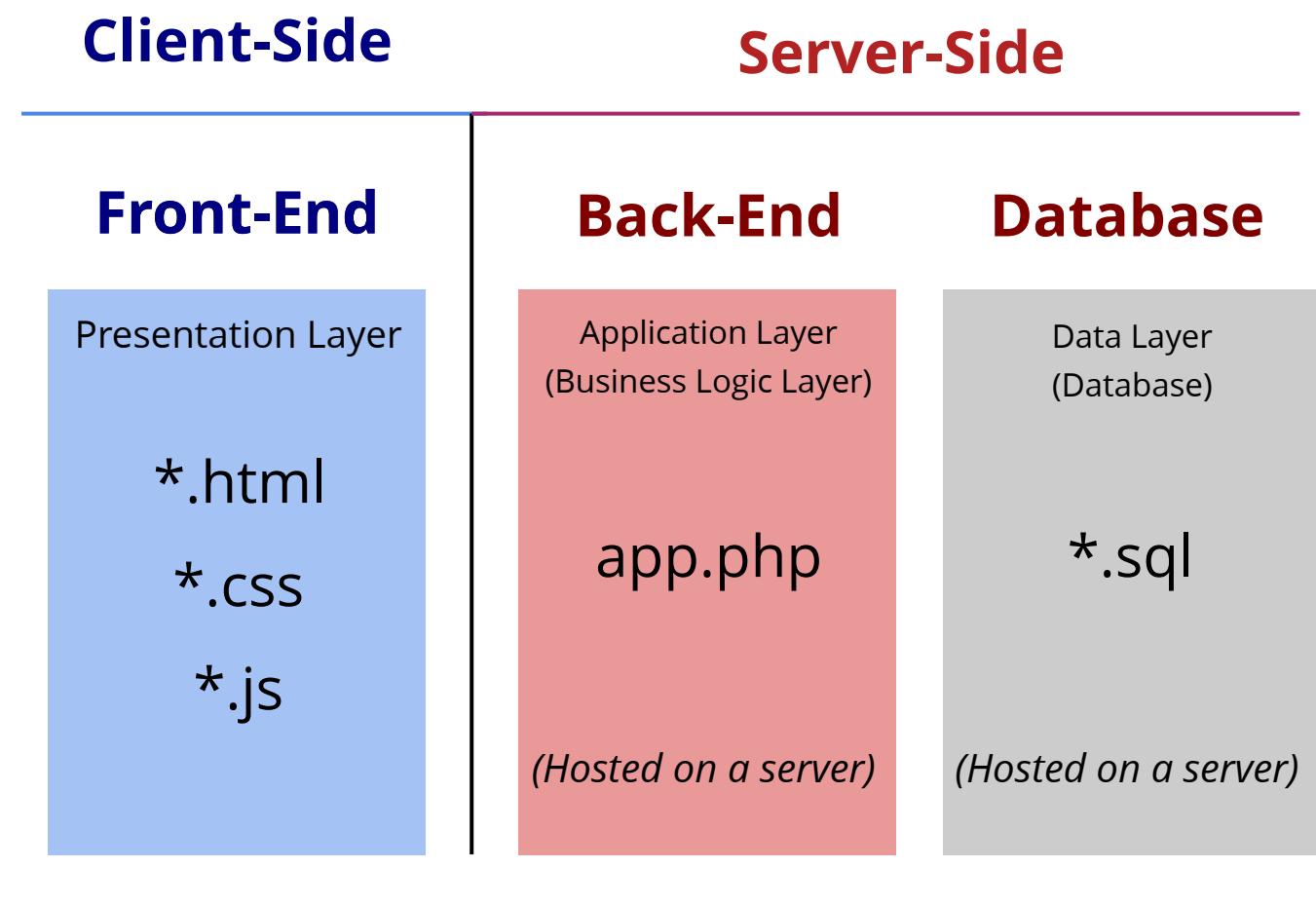
R: Read

U: Update

D: Delete

+ Other Essential Features:

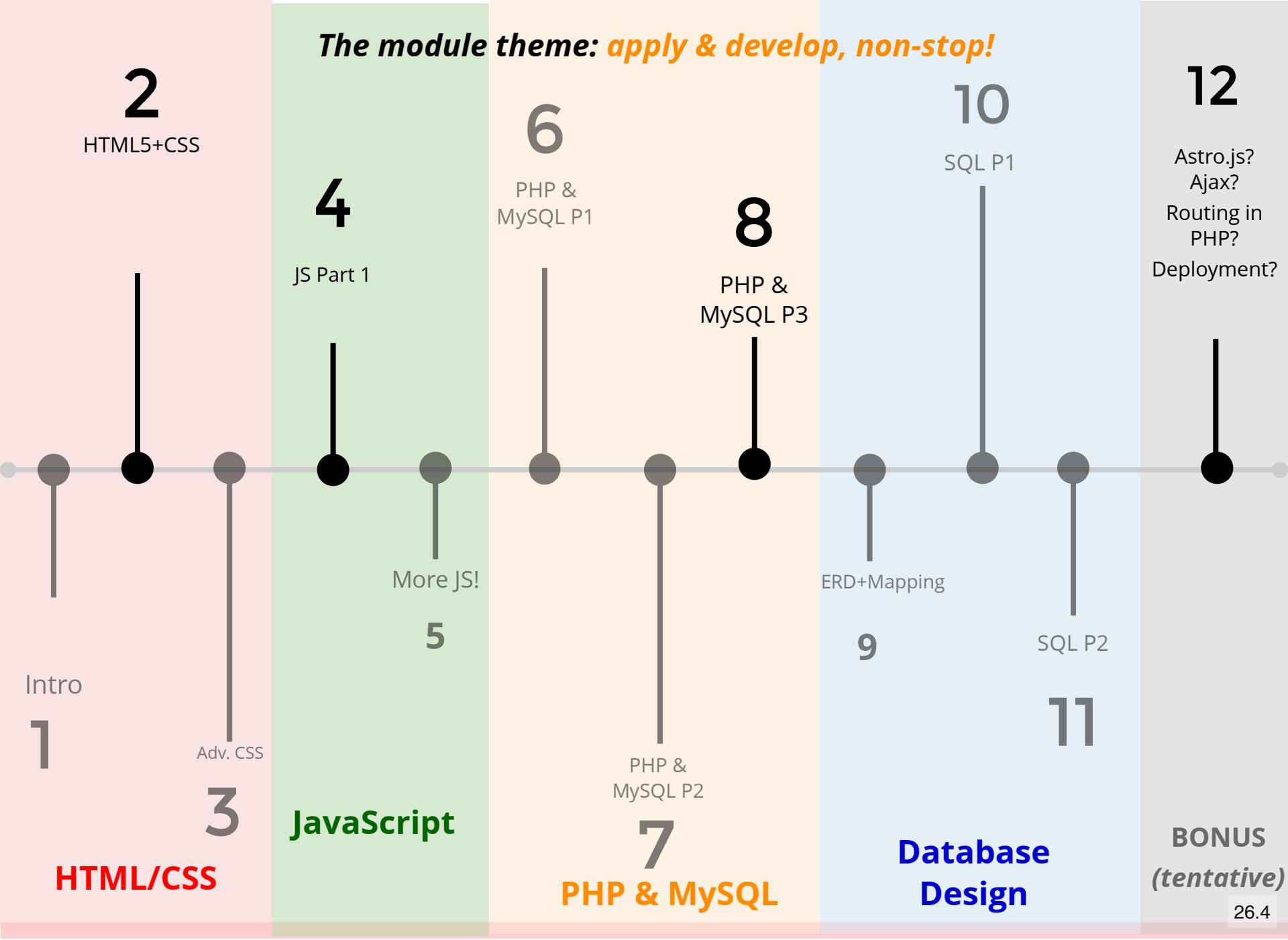
- Login Platform
- Sessions
- Cookies
- & more..



Bottom-line: If you are able to build something from scratch (e.g.: Web app), You will be able to figure out all of it's vulnerabilities by doing multiple exploits, hence, you will be able secure all of it's gaps.



Tentative Weekly Plan





[optional]

Intro to SDLC, Deployment & Hosting (Software Development Life Cycle)

Requirements

Design

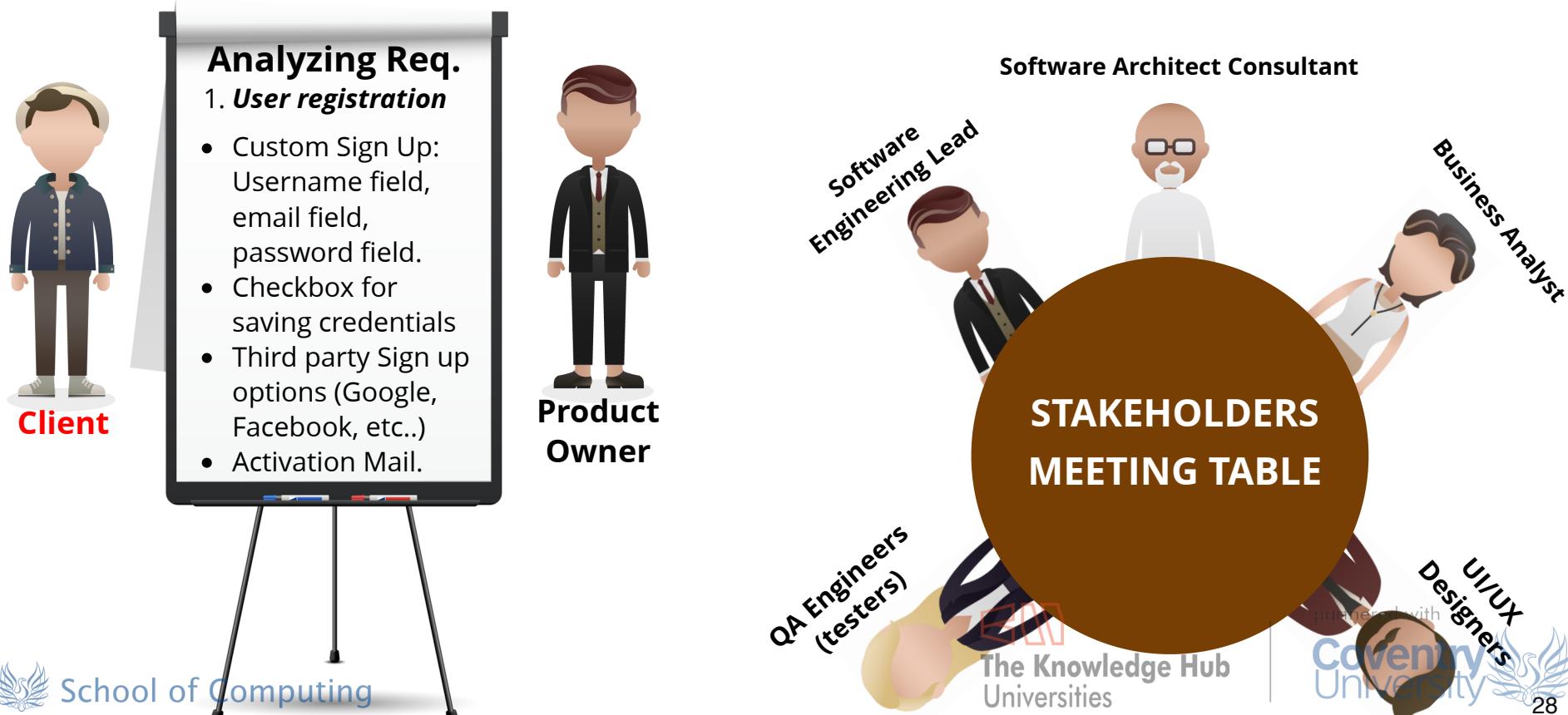
Implementation

Testing

Maintainance

The second step is **requirement Analysis**:

- The product owner sets up a meeting (or several ones) with the team, or the rest of stakeholders to define the main functionalities of the requested system. (*The client may would like to attend that meeting*)



Requirements

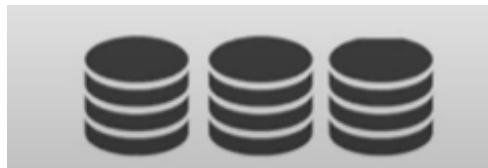
Design

Implementation

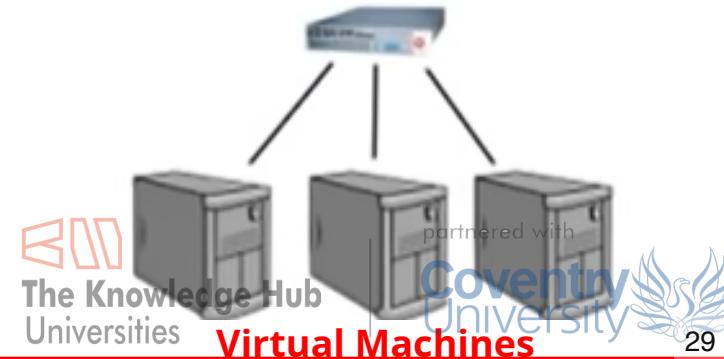
Testing

Maintainance

- User interface design, color themes, etc..
- **Conceptual/Design Models, Diagrams, workflows**, flowcharts, etc..
(This is one of the core topics that will be covered in this course)
- **System server design** (*infrastructure design*), Choosing a **cloud service provider** (Google cloud, AWS, AzureDevOps, etc..), **Setting up VMs to host the application**
- Choosing the **Programming languages**, framework/technologies, design patterns, architecture patterns to work with.
- Creating **Databases** for data persistence and manipulation.



Databases

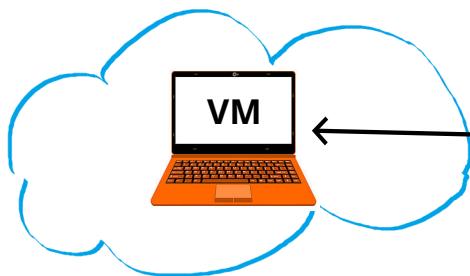


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SDLC

Deployment (**Cloud hosting vs local hosting**)

www.mywebsite.com



Hosting your app on a VM on the cloud will make it **accessible to everyone** (You can have a **link; domain name**; to the link share with anyone)

This can be google cloud, Amazon Web Services (AWS), Microsoft Azure

localhost



Deployment

Hosting your app on your **local** laptop, will make it only accessible on THAT machine.

Requirements

Design

Implementation

Testing

Maintainance

SDLC

Deployment (Cloud hosting)

Deployment

- Another terminology: "*Pushing product to Production*"
- **Production** always means **deployment (hosting)**; this means that **if the app is in production**, then **it got deployed successfully** and it is **live** on *Google Play, App Store, Microsoft Store* (for desktop apps), some *domain* (in case of a website)
- People who deploy are usually **developers** who implemented the code.
- The ones who decide which cloud provider and which VMs (what specs, memory, storage, OS, etc..) to choose are usually called **infrastructure engineer** or **cloud practitioners**.



Requirements

Design

Implementation

Testing

Maintainance

SDLC

Maintenance

- Usually done by **Maintenance** or **operations engineers** (or **DevOps** engineers)
- They are responsible for keeping the app **reliable**, optimized, **bug-free** on a 24-hrs basis.
- If any '**bug appeared in production**' (aka while the app is deployed and live), they immediately need to enter the scene and perform the needed '**hot fixes**'.



Requirements

Design

Implementation

Testing

Maintainance

SDLC

Deployment (Cloud hosting)

Deployment



Question: How to sync Production environment with Development environment?

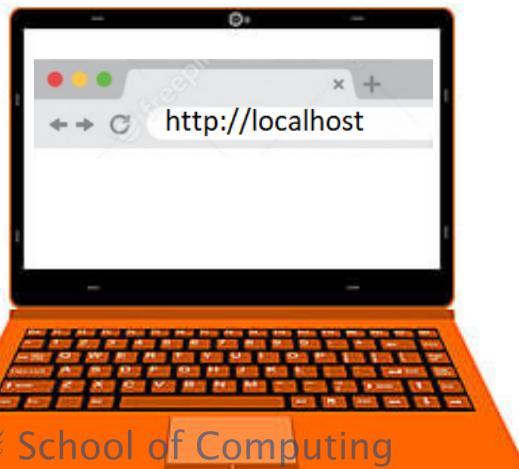
SDLC: Deployment (Cloud hosting)

Question: How to sync Production environment with Development environment?

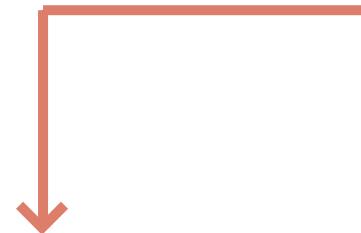
*Approach 1: Using basic **git and github workflow***

1. Push changes
from local to
shared repo

my laptop



Github Repo



Virtual Machine (on AWS cloud)



2. Pull changes
from shared repo
to VM
(production)

SDLC: Deployment (Cloud hosting)

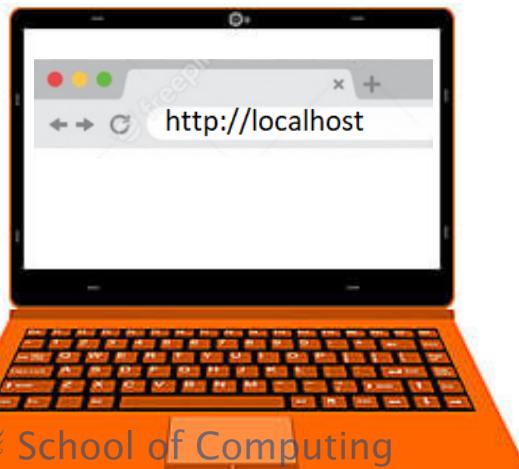
Question: How to sync Production environment with Development environment?

Approach 2: Automate the previous workflow via:

CI/CD Continuous integration (**CI**) and
continuous delivery (**CD**)

1. Push changes from local to shared repo

my laptop



Github Repo



Virtual Machine (on AWS cloud)



2. Pull changes from shared repo to VM (production)