COMP 307
Principles of Web Development

MCGILL UNIVERSITY

COMP 307

Principles of Web Development

Lecture 11

Unit 3 – Frontend Design

Libraries * Frameworks * Environments

Contents

Vue.js
Flexbox
Bootstrap

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Class Outline

- Performance
- Libraries vs Frameworks vs Environments
- Examples

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Readings

- Full Stack Developer
  - Chapters 9
- Internet Resources
  - https://vuejs.org/tutorial/#step-1
  - https://vuejs.org/guide/introduction.html
  - https://www.w3schools.com/css/css3_flexbox.asp
  - https://getbootstrap.com/
  - https://www.w3schools.com/bootstrap/bootstrap_ver.asp

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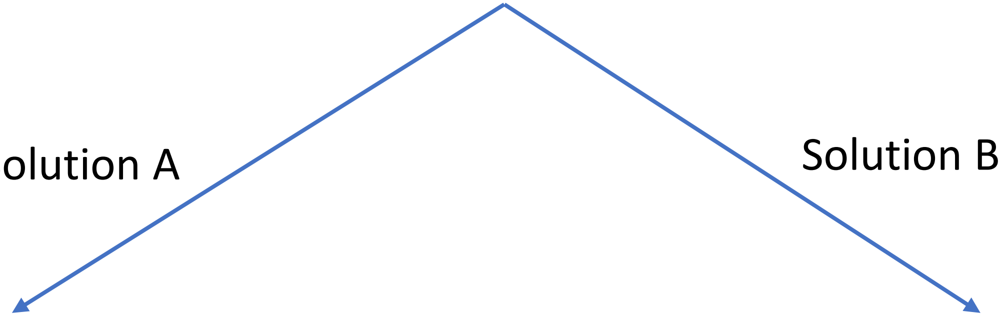
Performance

an important ient issue

Performance

The O(n^3) program is too slow



Solution A

Solution B

Rewrite algorithm to O(n^2) or O(nlog n)

Buy a faster computer

no often

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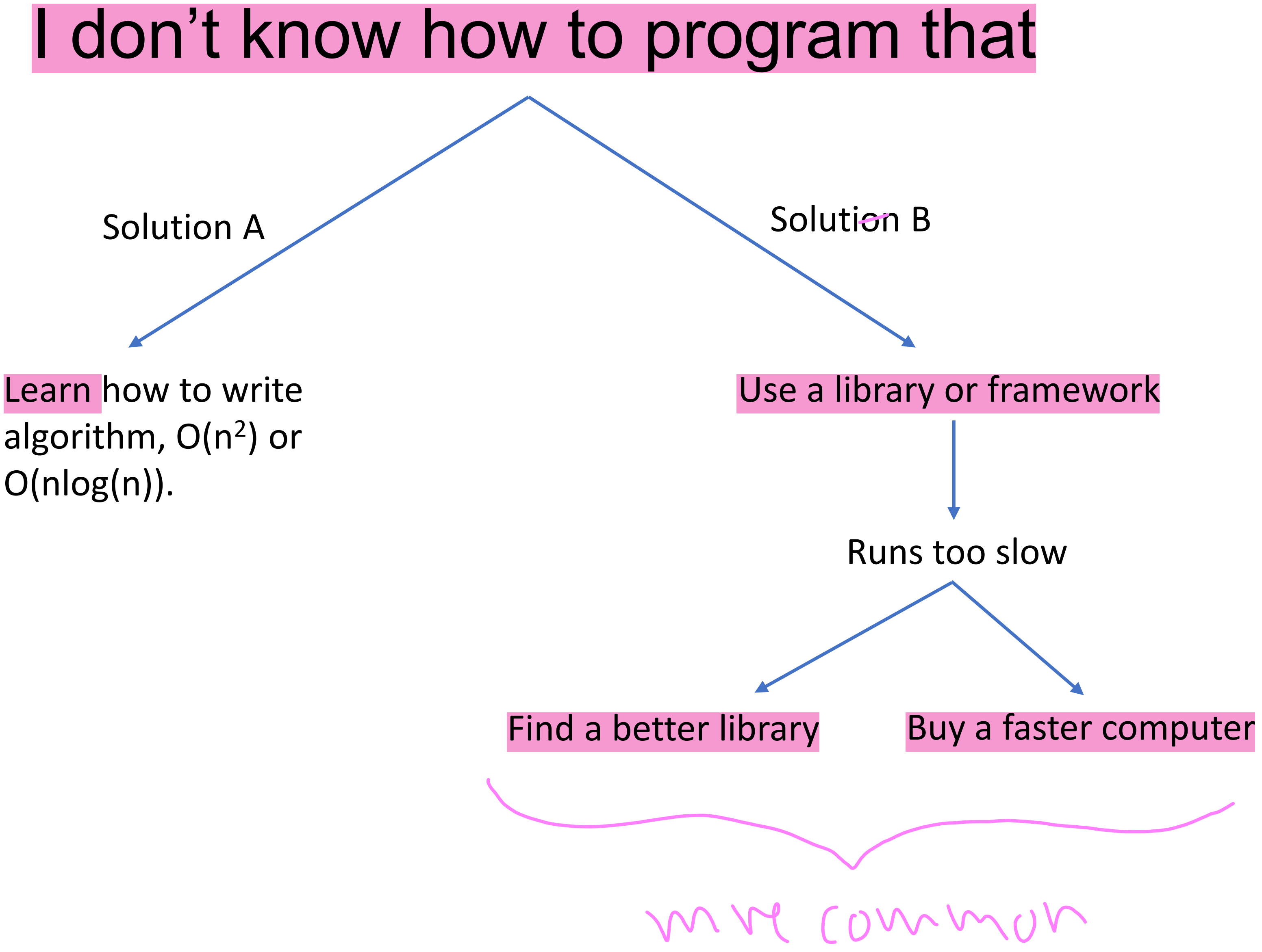
Performance



I don't know how to program that

Solution A

Solution B

Learn how to write algorithm, $O(n^2)$ or $O(n\log(n))$.

Use a library or framework

Runs too slow

Find a better library

Buy a faster computer

more common

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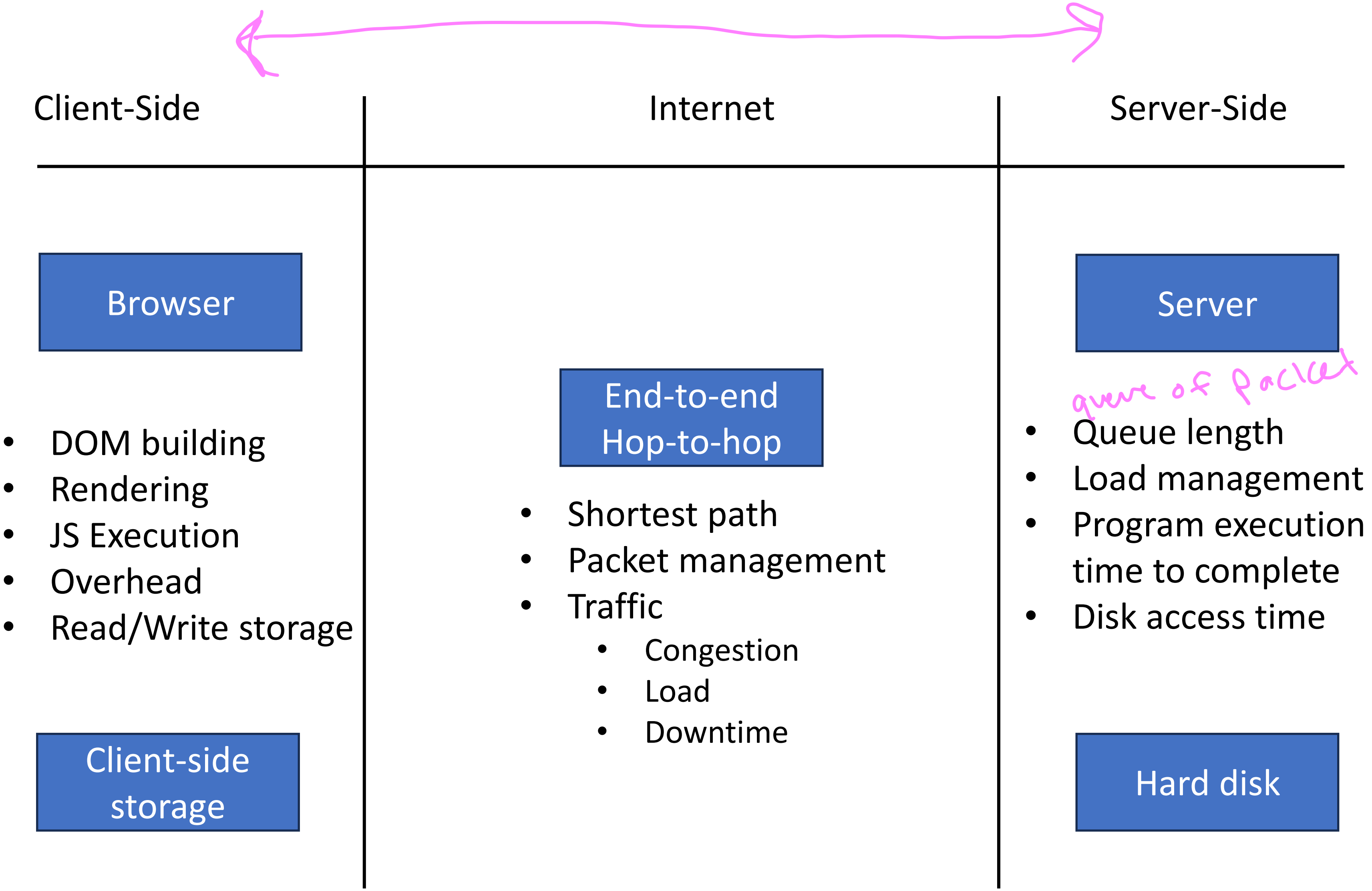
Performance



Client-Side

Internet

Server-Side

Browser

- DOM building
- Rendering
- JS Execution
- Overhead
- Read/Write storage

Client-side storage

End-to-end
Hop-to-hop

- Shortest path
- Packet management
- Traffic
  - Congestion
  - Load
  - Downtime

Server

queue of packet

- Queue length
- Load management
- Program execution time to complete
- Disk access time

Hard disk

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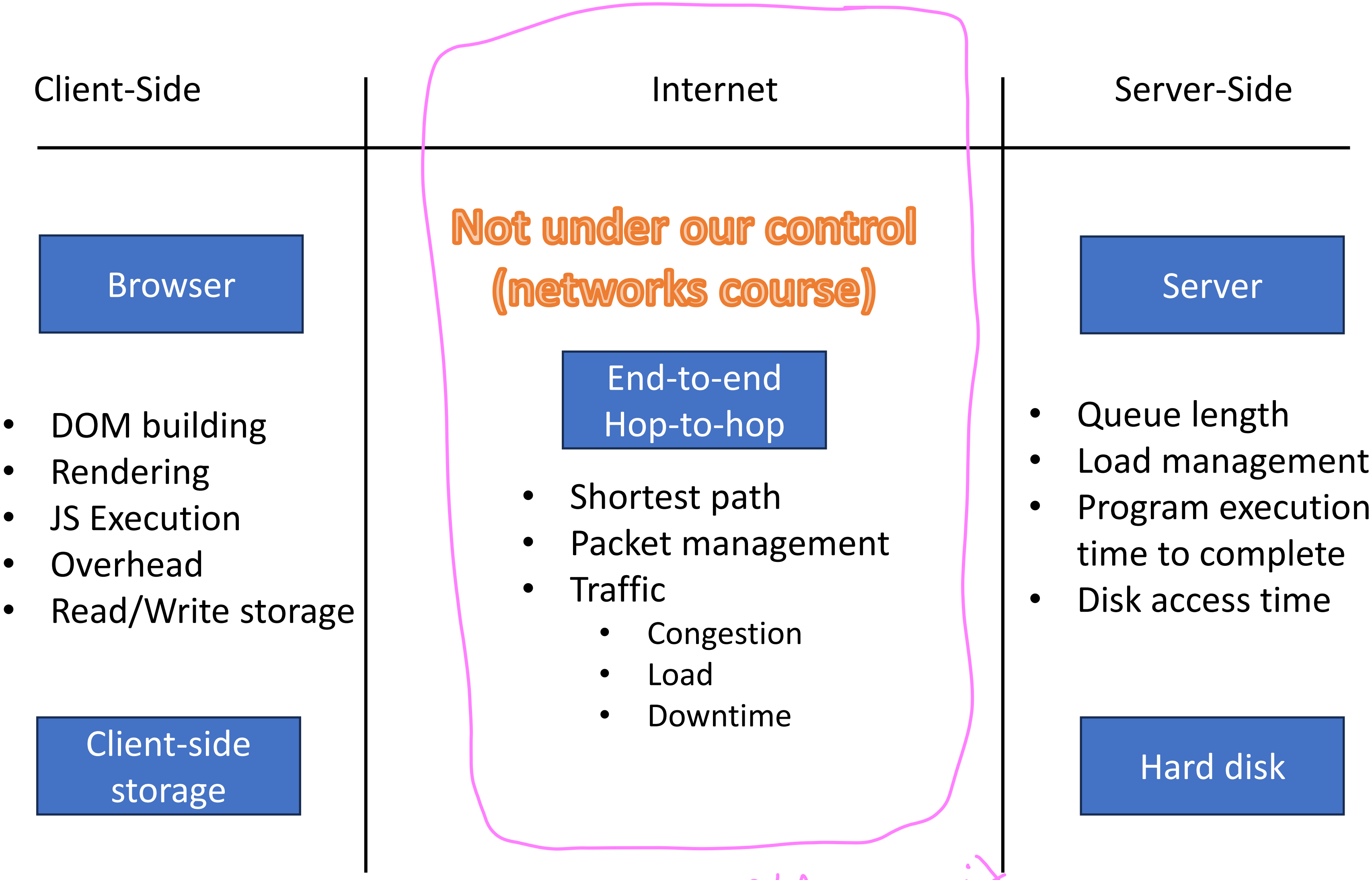
Performance



Client-Side

Browser

- DOM building
- Rendering
- JS Execution
- Overhead
- Read/Write storage

Client-side storage

Internet

Not under our control (networks course)

End-to-end
Hop-to-hop

- Shortest path
- Packet management
- Traffic
  - Congestion
  - Load
  - Downtime

Server-Side

Server

- Queue length
- Load management
- Program execution time to complete
- Disk access time

Hard disk

unless you pay someone to make it faster

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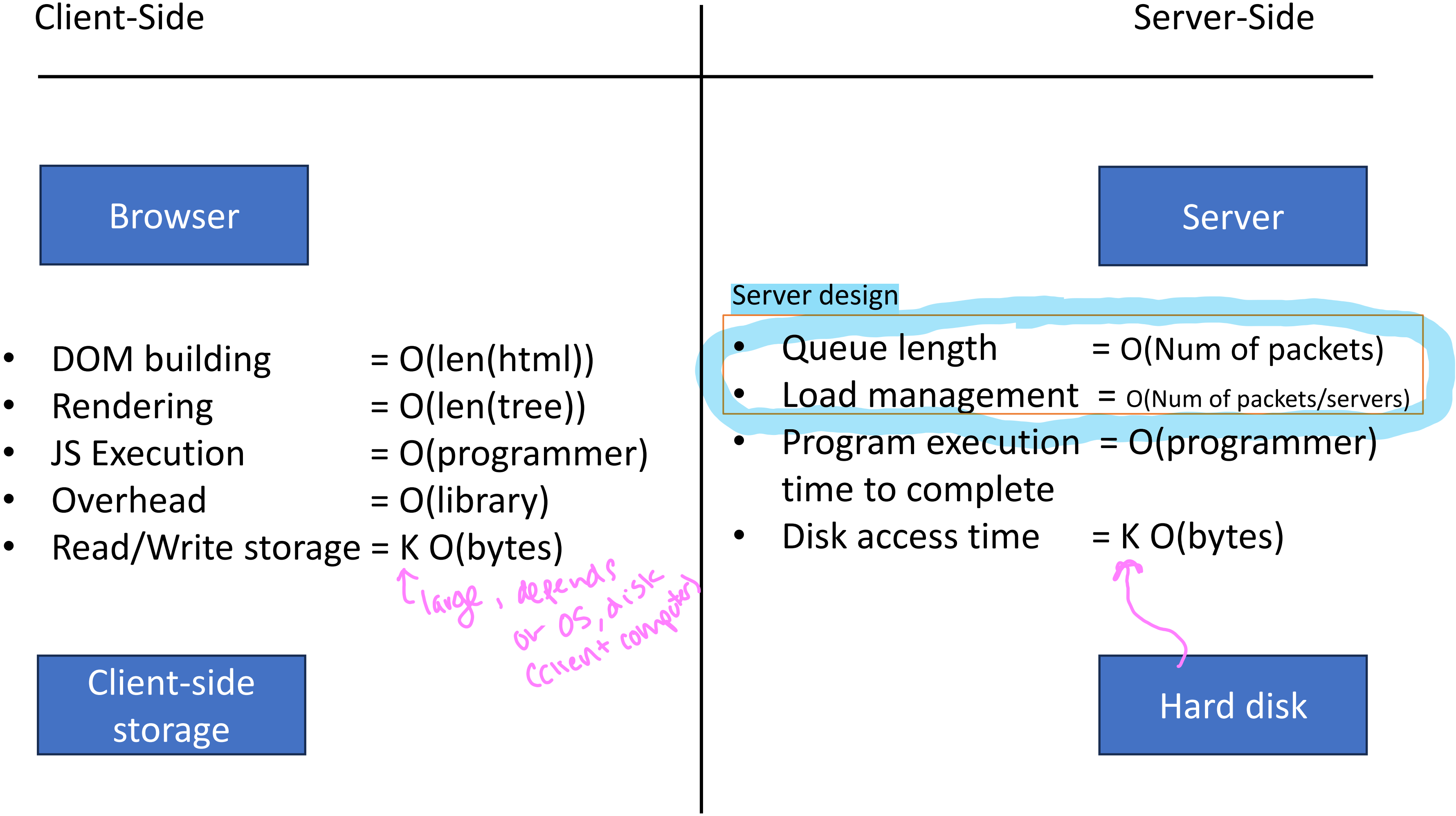
Performance

trade readability fr speed/size



Client-Side

Server-Side

Browser

- DOM building = O(len(html))
- Rendering = O(len(tree))
- JS Execution = O(programmer)
- Overhead = O(library)
- Read/Write storage = K O(bytes)

large, depends or OS, disk (client computer)

Client-side storage

Server

Server design

- Queue length = O(Num of packets)
- Load management = O(Num of packets/servers)
- Program execution time to complete = O(programmer)
- Disk access time = K O(bytes)

Hard disk

Where are the bottlenecks?

Performance

Client-Side

Browser

- DOM building = O(len(html))
- Rendering = O(len(tree))
- JS Execution = O(programmer)
- Overhead = O(library)
- Read/Write storage = K O(bytes)

Client-side storage

Server-Side

Server

- Queue length = O(Num of packets)
- Load management = O(Num of packets/servers)
- Program execution = O(programmer) time to complete
- Disk access time = K O(bytes)

Hard disk

have the most control over these

Where are the bottlenecks?

↑ don't just download stuff, think about it first

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Libraries vs Frameworks vs Environments

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What is a library

Example: `#include<math.h>`, in C.

A single file containing preprogrammed functions. Developers can include those files into their programs.

Simplifies development. Speeds the coding process.

The quality of the library is proportional to:

- Big Oh of the functions
- Worst case memory requirements

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What is a template

Example: premade webpage

It is skeleton or vanilla code of a partially completed page/algorithm. It may implement standards.

Instantly provides features you may want.

The quality of the template is proportional to:

- The developer's skill
- Free vs paid restrictions
- Sometimes refactoring a template is not worth the effort

↳ then you get in trouble if you need to change something later

https://www.w3schools.com/css/css_rwd_templates.asp

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What is a framework

Example: `W3.CSS`.

A collection of interdependent libraries that impose a convention on the development process.

Gives the developer a new way to look at solving a problem. Provides a set of tools.

The quality of the framework is proportional to:

- The libraries it requires
- The usefulness of the convention

https://www.w3schools.com/w3css/default.asp

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What is an environment

Example: `React`.

A collection of interdependent libraries that impose a convention on the development process, that has a specially designed run-time environment (the Engine) to execute the code.

Gives the developer a new way to look at solving a problem. Provides a set of tools.

The quality of the framework is proportional to:

- Overhead from the Engine

node.js is a backend version

Issues

Example: `WordPress`.

This is both an IDE and an Engine, with plugins (as a replacement to libraries).

A common issue with coding simplification through external tools:

- "trying to put a round peg in a square hole…"

Originally, WordPress, was a Blogging platform… now, this round peg is being used to create many square holes.

eg changing a blog post
t be a web page

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Examples

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Bootstrap

Example of library and template

What is Bootstrap?

- A **library** and **template** files of HTML, CSS and JS designed to work together providing the developer a set of well-tested code to build their website
  - https://getbootstrap.com/
- Alternatives
  - W3schools Templates (https://www.w3schools.com/css/css_rwd_templates.asp)
  - W3schools Frameworks (https://www.w3schools.com/w3css/defaulT.asp)

Bootstrap

Let us look around the website:

https://getbootstrap.com/

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Bootstrap

Let us look at the pricing example

- Uses cards

Card class

could use whole webpage or just div

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Flexbox

Example of a framework

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What is Flexbox?

- Before the Flexbox Layout module, there were four layout modes:
  - Block, for sections in a webpage
  - Inline, for text
  - Table, for two-dimensional table data
  - Positioned, for explicit position of an element

+ floating

- The Flexible Box Layout Module, makes it easier to design flexible responsive layout structure without using float or positioning.

dont overuse
↳ nesting can destabalize

kind of built in now to CSS
(flex)

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Basic

```
<!DOCTYPE html>
<html>
 <head>
  <style>
   .flex-container {
    display: flex;
    background-color: DodgerBlue;
   }

   .flex-container > div {
     background-color: #f1f1f1;
     margin: 10px;
     padding: 20px;
     font-size: 30px;
   }
  </style>
 </head>
<body>

<h1>Create a Flex Container</h1>

<div class="flex-container">
 <div>1</div>
 <div>2</div>
 <div>3</div>
</div>

</body>
</html>
```

Parent's display set to flex

Children become flexible

now floats left

<div> would normally organize below one another

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Flex Properties

- flex-direction – direction of stacking
- flex-wrap – to wrap or not
- flex-flow – shorthand for flex-direction and flex-wrap
- justify-content – about aligning items
- align-items – about aligning items
- align-content – about aligning items

Contents

Example

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  flex-direction: column-reverse;
  background-color: DodgerBlue;
}

.flex-container > div {
  background-color: #f1f1f1;
  width: 100px;  margin: 10px;  text-align: center;  line-height: 75px;  font-size: 30px;
}
</style>
</head>

<body>
<h1>The flex-direction Property</h1>

<div class="flex-container">
  <div>1</div>
  <div>2</div>
  <div>3</div>
</div>

</body>
</html>
```

will reverse content of div

In reverse order

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Example

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  flex-wrap: wrap;
  background-color: DodgerBlue;
}

.flex-container > div {
  background-color: #f1f1f1;
  width: 100px;  margin: 10px;  text-align: center;  line-height: 75px;  font-size: 30px;
}
</style>
</head>
<body>

<div class="flex-container">
  <div>1</div>  <div>2</div>  <div>3</div>   <div>4</div>
  <div>5</div>  <div>6</div>   <div>7</div>  <div>8</div>
  <div>9</div>  <div>10</div>  <div>11</div>  <div>12</div>
</div>

<p>Try resizing the browser window.</p>

</body>
</html>
```

Row wrapping

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Example

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  justify-content: flex-end;
  background-color: DodgerBlue;
}

.flex-container > div {
  background-color: #f1f1f1;
  width: 100px;  margin: 10px;  text-align: center;  line-height: 75px;  font-size: 30px;
}
</style>
</head>
<body>

<div class="flex-container">
  <div>1</div>
  <div>2</div>
  <div>3</div>
</div>

</body>
</html>
```

Justifies to right side of area

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Flex Item (child) Control

- **order** – the order they will apear
- **flex-grow** – item larger relative to the rest
- **flex-shrink** – item smaller relative to the rest
- **flex-basis** – sets the length of an item
- **flex** – shorthand for flex-grow –shink -basis
- **align-self** – alignment within container

https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_align-self_center
https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_align-self_flex
https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_flex

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Flex Responsive

https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_responsive2

https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_image_gallery

https://www.w3schools.com/css/tryit.asp?filename=trycss3_flexbox_website2

Let’s break this down

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Vue.js

Example of framework and environment

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What is Vue.js?

- Vue (pronounced /vjuː/, like view) is a JavaScript **framework** for building user interfaces. It builds on top of standard HTML, CSS and JavaScript, and provides a declarative and component-based programming model that helps you efficiently develop user interfaces.
  - https://vuejs.org/
  - Filename.vue files

This design is a framework because you can opt out of it, technically – but is implemented as an **engine**.

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Elements of Vue.js

Vue’s framework uses JS’s export to share the label **default** with the framework.

variable that vue expects you to use

```
<script>
export default {
  data() {
    return {
      count: 0
    }
  },
  methods: {
    increment() {
      this.count++
    }
  }
}
</script>
```

Initial values

An augmented JS Syntax

data is a reserved word for global variables

an array

```
<template>
  <button @click="increment">count is: {{ count }}</button>
</template>
```

is 0 at load

An expanded HTML Syntax

ve syntax

Vue engine knows how to interpret

https://vuejs.org/tutorial/#step-4

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Elements of Vue.js

An augmented JS Syntax

```
<script>
export default {
  data() {
    return {
      text: ''
    }
  },
  methods: {
    onInput(e) {
      this.text = e.target.value
    }
  }
}
</script>
```

<input>'s value attribute

```
<template>
  <input :value="text" @input="onInput" placeholder="Type here">
  <p>{{ text }}</p>
</template>
```

An expanded HTML Syntax

html - attribute
Vue - statement

ap ears live in <p>

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Elements of Vue.js

An augmented JS Syntax

```
<script>
export default {
  data() {
    return {
      awesome: true
    }
  },
  methods: {
    toggle() {
      this.awesome = !this.awesome
    }
  }
}
</script>
```

Starts at t

on toggle
switch
awesome v

An expanded HTML Syntax

```
<template>
  <button @click="toggle">toggle</button>
  <h1 v-if="awesome">Vue is awesome!</h1>
  <h1 v-else>Oh no 😥</h1>
</template>
```

- togg true
- toggle false

Vue if-else

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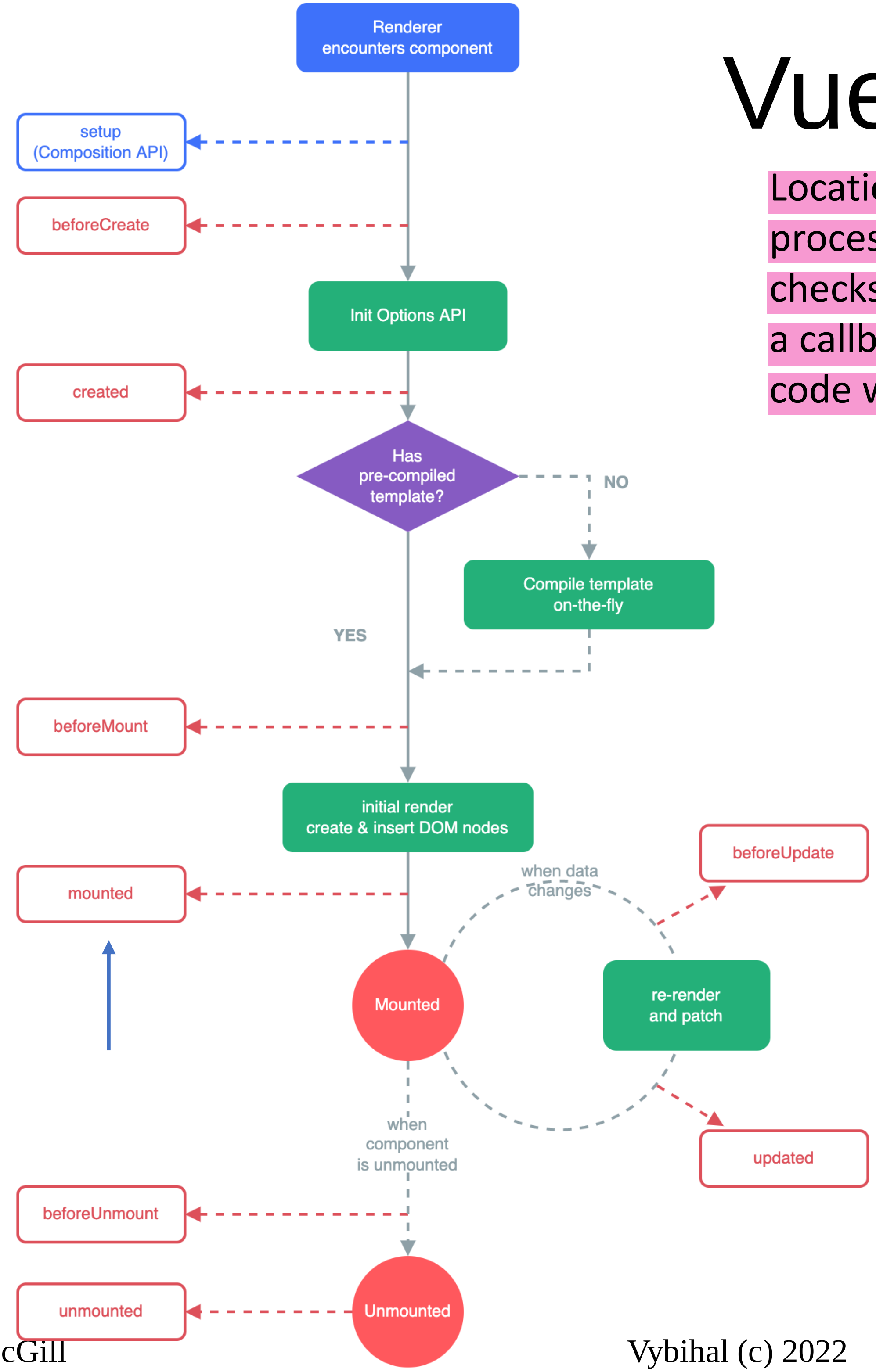

Vue.js Hooks

Locations in the framework's processing cycle where it checks to see if you have setup a callback function in your code with the hook's name.

```
<script>
export default {
  mounted() {
    this.$refs.p.textContent = 'mounted!'
  }
}
</script>

<template>
  <p ref="p">hello</p>
</template>
```

engine

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Prepare for Next Class

- Assignments
  - Mini 4 given
- Labs this week
  - Lab B – Bootstrap, TA will cover this after the break. You can try on your own now.
- Do on your own
  - Download Vue.js and try to build a webpage using it
  - Which framework is more computationally expensive: Flexbox or Vue.js ?

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