Full Stack Application Development- SE ZG503

BITS Pilani
Pilani Campus

Akshaya Ganesan
CSIS, WILP

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Lecture No: 2 – Application Architectures

Activity

Web site: https://whatismyipaddress.com/

API : https://api.ipify.org/?format=json

Layered Pattern

Context: Separation of concern

Problem: Modules of the system may be independently developed and maintained, supporting portability, modifiability, and reuse.

Solution: The layered pattern divides the software into units called layers.

Each layer is a grouping of modules that offers a cohesive set of services.

Each partition is exposed through a interface.

Layers interact according to a strict ordering relation and unidirectional.

Web Application

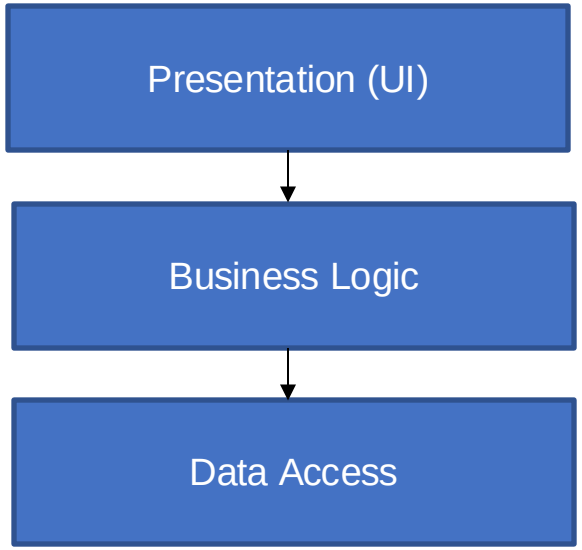
Web application follows the Layered Architecture.

Two-layer systems

- Typical client-server system
- The client held the user interface and other application code, and the server was usually a relational database.
- Embed the logic directly into the UI screens
- Alternative: put the domain logic in the database as stored procedures

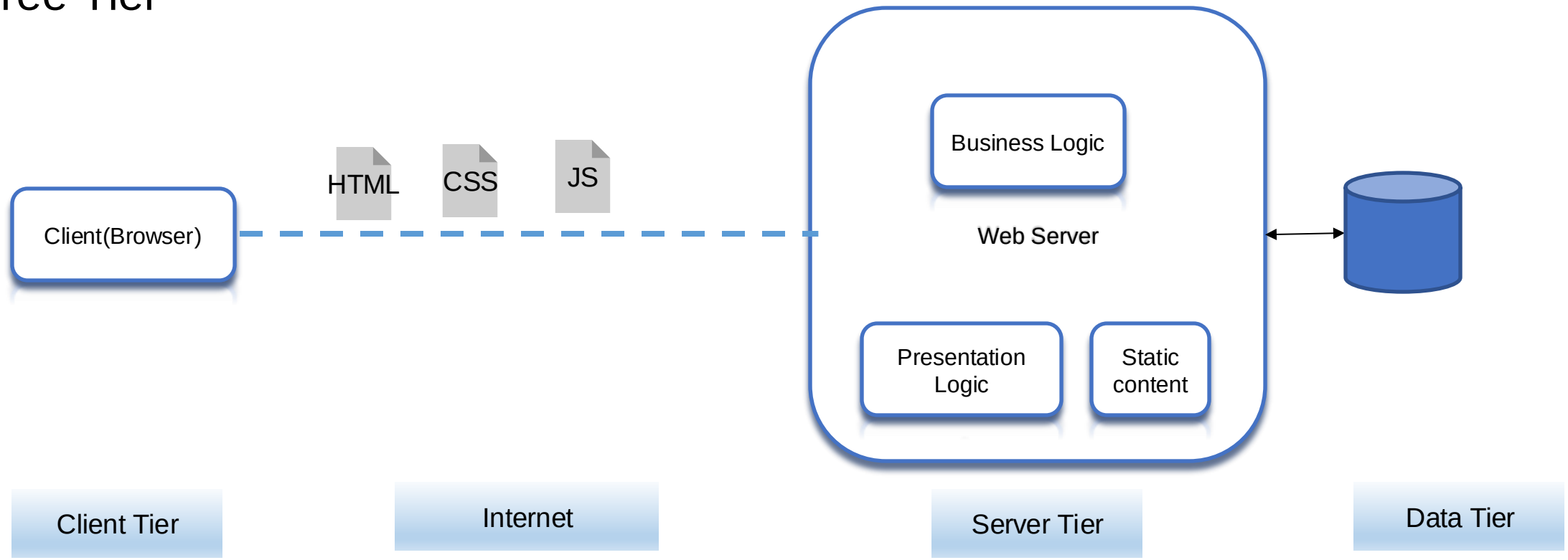
3-Tier Architecture

A typical Web Application:



Traditional Web Application

Three Tier



Ensuring a clear separation of concern

Scenario 1: A list of products in which all the products that sold over 10 percent more than they did the previous month were colored in red.

Method 1: (putting domain logic into the presentation)

Developers placed logic in the presentation layer that compared this month's sales to last month's sales, and if the difference was more than 10 percent, they set the color to red

Method 2:

To properly separate the layers, you need a method in the domain layer to indicate if a product has improved sales. This method makes the comparison between the two months and returns a Boolean value.

The presentation layer then calls this Boolean method and, if true, highlights the product in red.

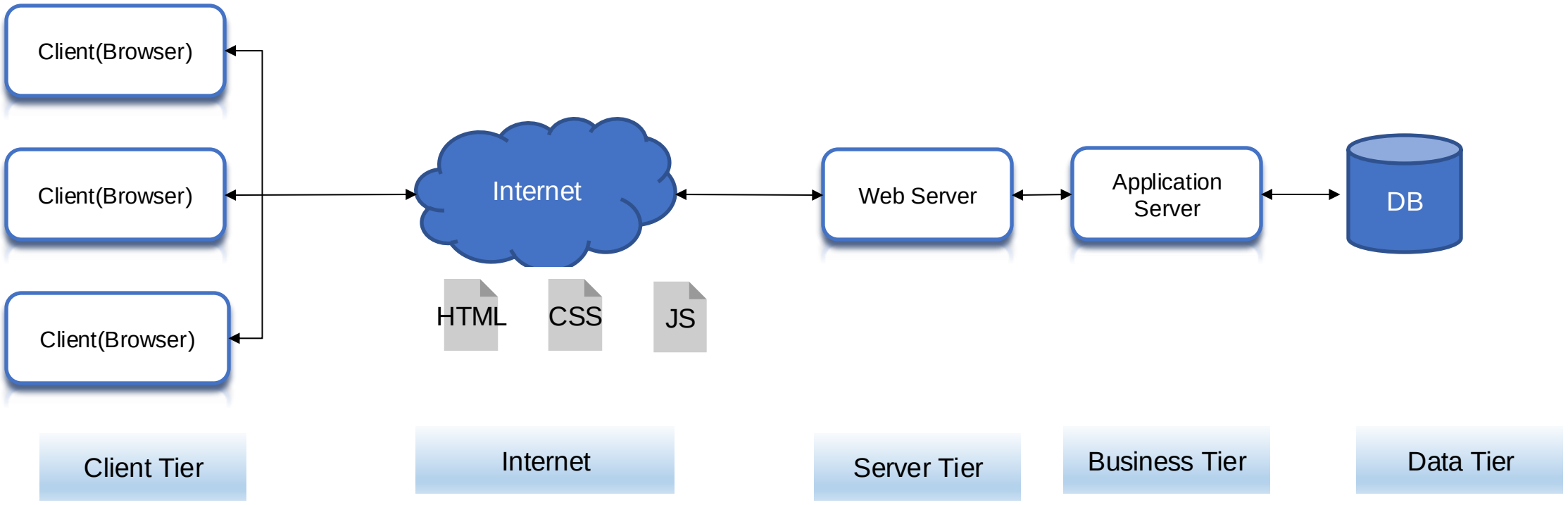
Scenario 2: (Test Your Application informally)

Scenario 2: You need to add different layers to an application, such as a command-line interface to a Web application.

Method: If there's any functionality you have to duplicate to do this, that's a sign of where domain logic has leaked into the presentation

Similarly, do you have to duplicate logic to replace a relational database with an XML file?

N-Tier Web Application



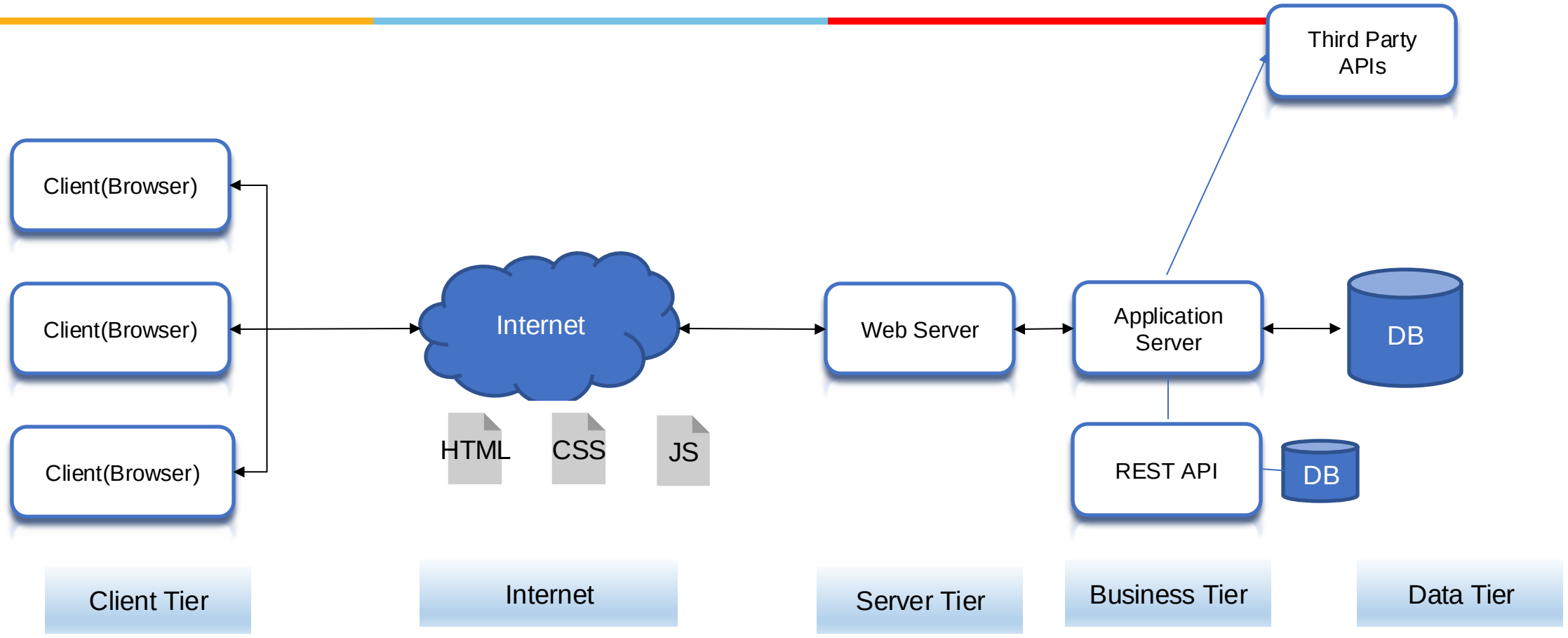
Characteristics

Each tier is completely independent.

The nth tier only has to know how to handle a request from the n+1th tier

Tiers make it easier to ensure security and to optimize performance and availability in specialized ways.

Service Based Web Application



Monolithic Application

The application is deployed as a single monolithic application.

For example, a Java web application consists of a single WAR file that runs on a web container such as Tomcat

Difficulty to scale

Redeployment of the entire application in case of change

Service Oriented Architecture

Service-oriented architecture (SOA) is a business-centric IT architectural approach that supports integrating your business as linked, repeatable business tasks or services.

SOA exposes business functionalities as services to be consumed by applications.

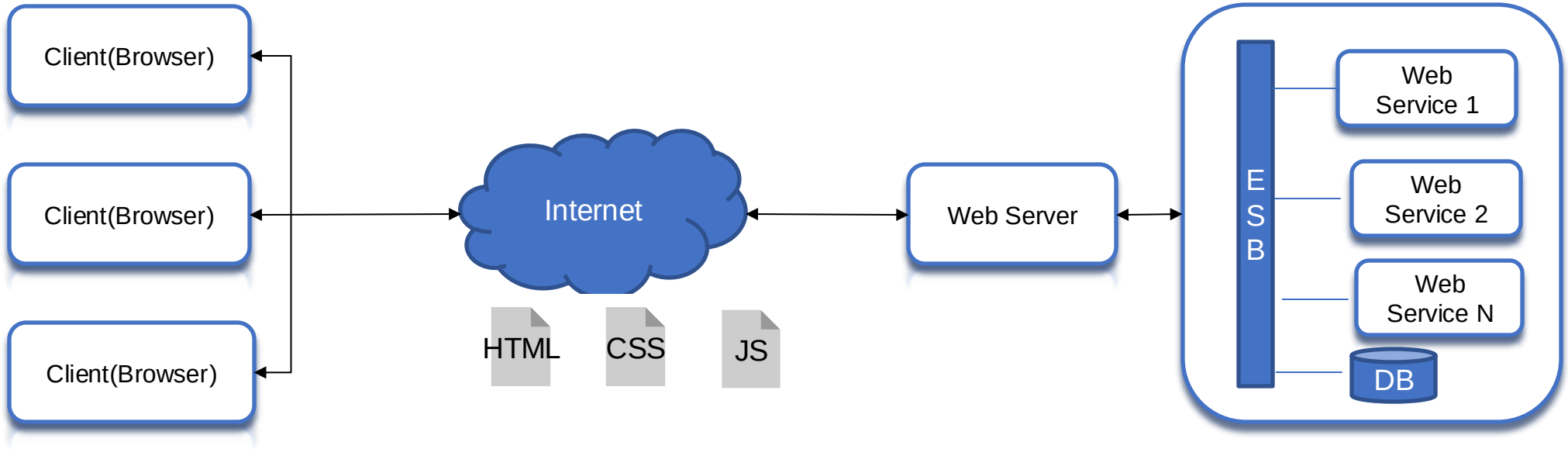
Services are

- loosely coupled
- Autonomous

Robert C. Martin's Single Responsibility Principle

Gather together the things that change for the same reasons. Separate those things that change for different reasons.

SOA Based Web Application



Microservice Architecture

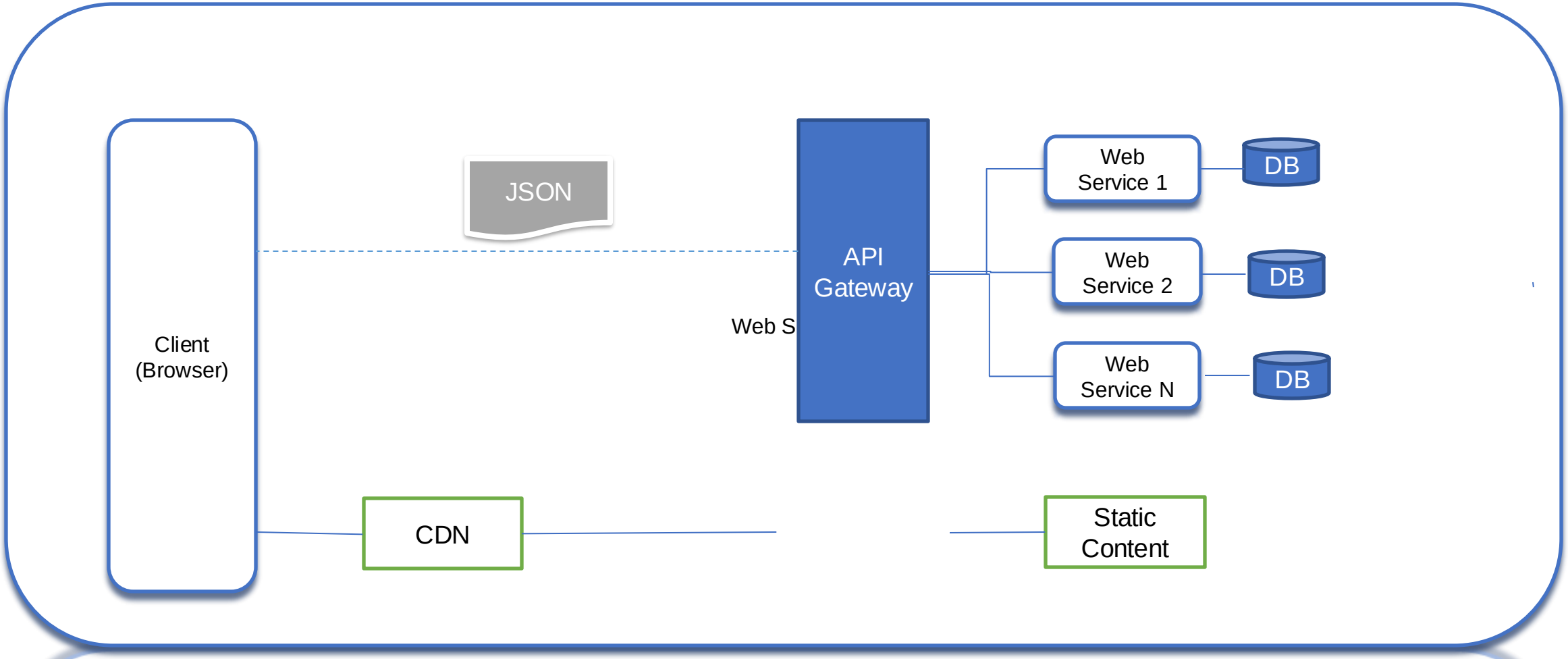
Microservice Application

- ✓ is composed of many small, independent services
- ✓ each service implements a single business capability
- ✓ are loosely coupled, communicating through API contracts
- ✓ can be built by a small, focused development team

More complex to build and manage

- ✓ requires a mature development and DevOps culture
- ✓ can lead to higher release velocity, and a more resilient architecture

Microservices Application



API

API stands for ‘Application Programming Interface’

API: an interface to access whatever resource it points to: data, server software, or other applications

In an internet-connected world, web and mobile applications are designed for humans to use

While APIs are designed for other digital systems and applications to use

What is a API?

An API is a software intermediary that allows two applications to talk to each other

- ✓ API is the messenger that delivers your request to the provider that you're requesting it from and then delivers the response back to you

An API is independent of their respective implementations.

Changing the underlying implementation ca be done without affecting the users

APIs make it possible to integrate different systems together

- ✓ like Customer Relationship Management systems, databases, or even school learning management systems

What is a API?

In this metaphor, a customer is like a user, who tells the waiter what she wants

The waiter is like an API,

- ✓ receiving the customer's order
- ✓ translating the order into easy-to-follow instructions that the kitchen then uses to fulfill that order—often following a specific set of codes
- ✓ or input, that the kitchen easily recognizes

The kitchen is like a server that creates the order in the manner the customer wants it, hopefully!

When the food is ready, the waiter picks up the order and delivers it to the customer.

Similarly, the API delivers the response.

Public APIs vs. Private APIs

Public API

- Twitter API, Facebook API, Google Maps API, and more
- Granting Outside Access to Your Assets
- Provide a set of instructions and standards for accessing the information and services being shared
- Making it possible for external developers to build an application around those assets
- Much more restricted in the assets they share, given they're sharing them publicly with developers around the web

Private API

- Self-Service Developer & Partner Portal API
- Far more common (and possibly even more beneficial, from a business standpoint)
- Give developers an easy way to plug right into back-end systems, data, and software
- Letting engineering teams do their jobs in less time, with fewer resources
- All about productivity, partnerships, and facilitating service-oriented architectures

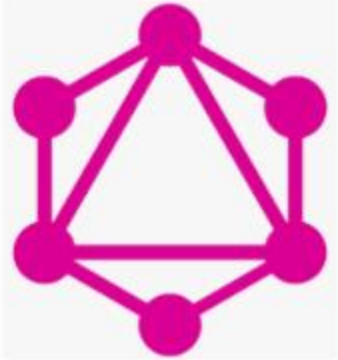
API Paradigm

Over the years, multiple API paradigms have emerged such as

- ✓ REST
- ✓ RPC
- ✓ GraphQL
- ✓ WebHooks
- ✓ and WebSockets

Broadly can be classified as

- ✓ Request-Response APIs
- ✓ Event Driven APIs



Request-Response APIs

Typically expose an interface through a HTTP-based web server

APIs define a set of endpoints

- ✓ Clients make HTTP requests for data to those endpoints
- ✓ Server returns responses

The response is typically sent back as JSON or XML

Three common paradigms used to expose request–response APIs:

- ✓ REST
- ✓ RPC
- ✓ and GraphQL

Model View Controller (MVC)

Software design pattern commonly used for developing user interfaces that divides the related program logic into three interconnected elements

Supported well in JavaScript, Python, Ruby, PHP, Java, C#

Three main logical components:

- the **model**,
- the **view**, and
- the **controller**.

Separates functionality

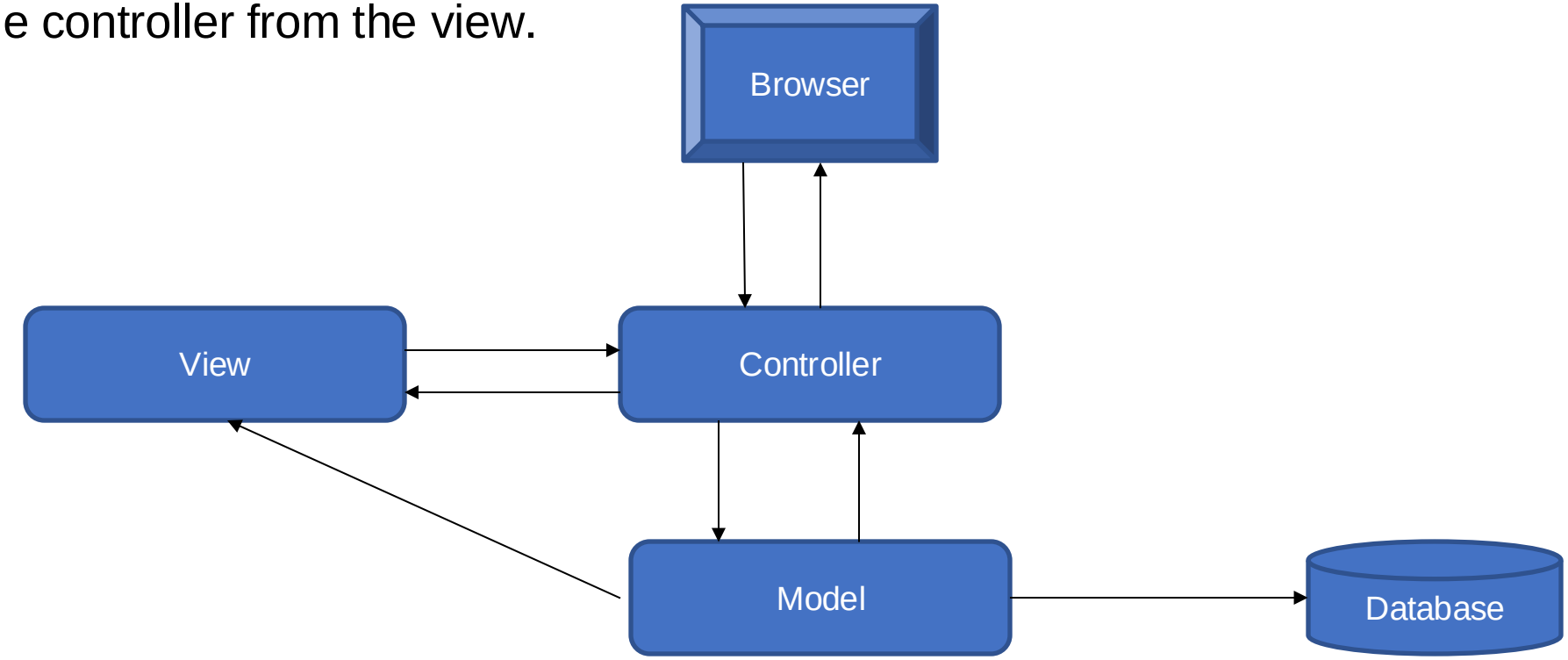
Promotes organized programming

Model View Controller (MVC)

Two principal separations:

Separating the presentation from the model and

Separating the controller from the view.



Model

Data related Logic

Interacts with the Database

Communicated with controller

Updates view (on few Frameworks)

View

User Interface

Communicates with controller

Template engines

Implementing the view in MVC

- Template View and

Renders information into HTML by embedding markers in an HTML page.

- Transform View

writing a program that looks at domain-oriented data and converts it to HTML.

Controller

Receives input(from view)

Process request(GET, POST)

Gets data from the model

Pass data to view

Load a plain view(static HTML pages)

Implementing Controller

- Page controller
- Front controller
- Application controller

Example: http://mywebsite/users/profiles/1

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/routes

- `Users/profiles/id = Users.getUser(id)`

/controllers

```
Class Users{
function getUser(id){
Profile=this.UserModel.getUser(id)
renderView("/users/profiles", profile)
}
}
```

/Models

```
Class UserModel{
getUser(id){ sql query to db , return data}
}
```

Example

/views

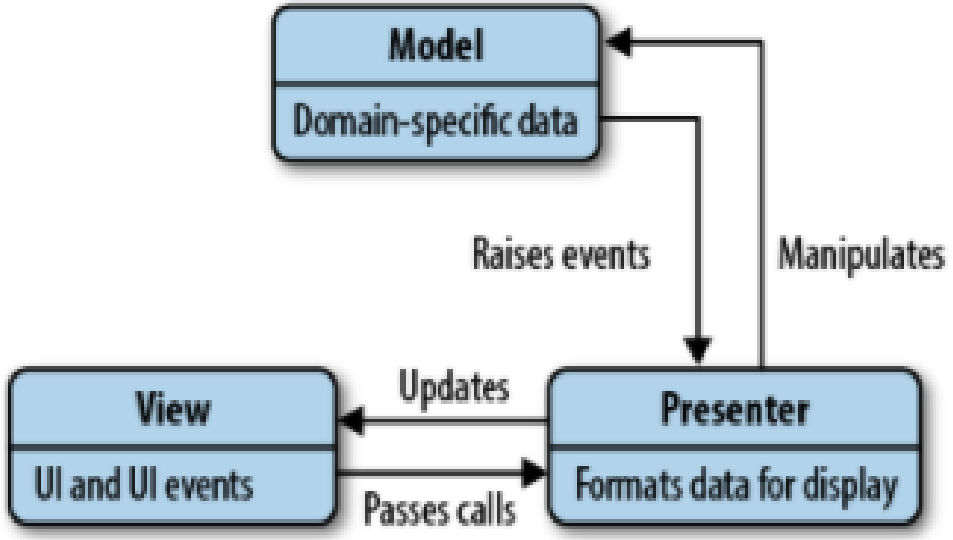
/users

/profile

```
<h1> {{profile.name}}</h1>
<ul>
    <li>email : {{profile.email}}</li>
    <li>Phone: {{profile:phone}}</li>
</ul>
```

Model View Presenter

The view is a passive interface that displays data (the model) and routes user commands (events) to the presenter to act upon that data.



MTV (Model, Template, and View)

This Model similar to MVC acts as an interface for your data

The View executes the business logic and interacts with the Model and renders the template.

It accepts HTTP request and then return HTTP responses.

The Template is the component which makes MVT different from MVC.

Templates act as the presentation layer and are basically the HTML code that renders the data.

The content in these files can be either static on dynamic.

Self Reading

https://www.ibm.com/think/topics/monolithic-vs-microservices

https://litslink.com/blog/single-page-vs-multi-page-applications-benefits-drawbacks-and-pitfalls

References

1. https://developer.mozilla.org/en-US/
2. Full Stack Web Development: The Comprehensive Guide by Philip Ackermann Shroff/Rheinwerk Computing; First Edition (2 August 2023)

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Thank you