What is
Full Stack Web Development?

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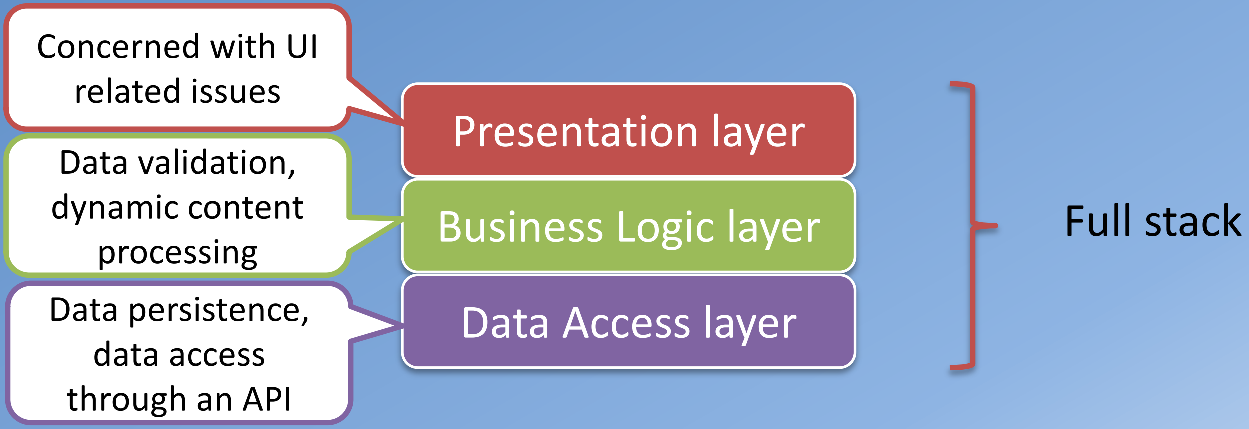
Front end and Back end

- Front end / Client-side
  - HTML, CSS and Javascript
- Back end / Server-side
  - Various technologies and approaches
  - PHP, Java, ASP.NET, Ruby, Python

https://en.wikipedia.org/wiki/Front_and_back_ends

Three Tier Architecture



Concerned with UI related issues

Data validation, dynamic content processing

Data persistence, data access through an API

Presentation layer

Business Logic layer

Data Access layer

Full stack

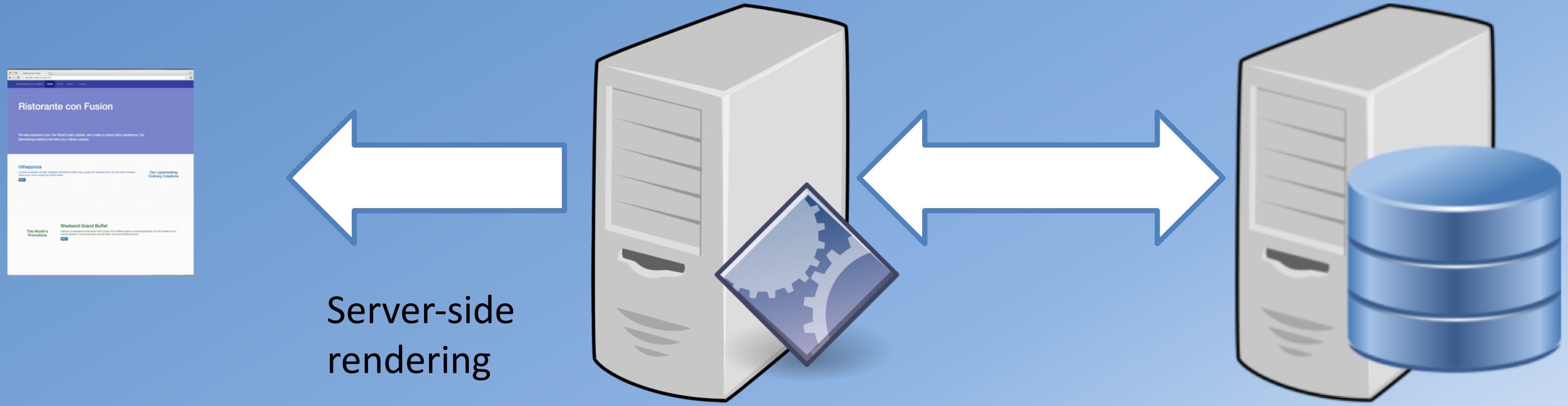
https://en.wikipedia.org/wiki/Multitier_architecture#Three-tier_architecture
http://www.tonymarston.net/php-mysql/3-tier-architecture.html

Traditional Web Development

HTML, CSS, JS

Ruby, Python, Java, C++, PHP

DBMS



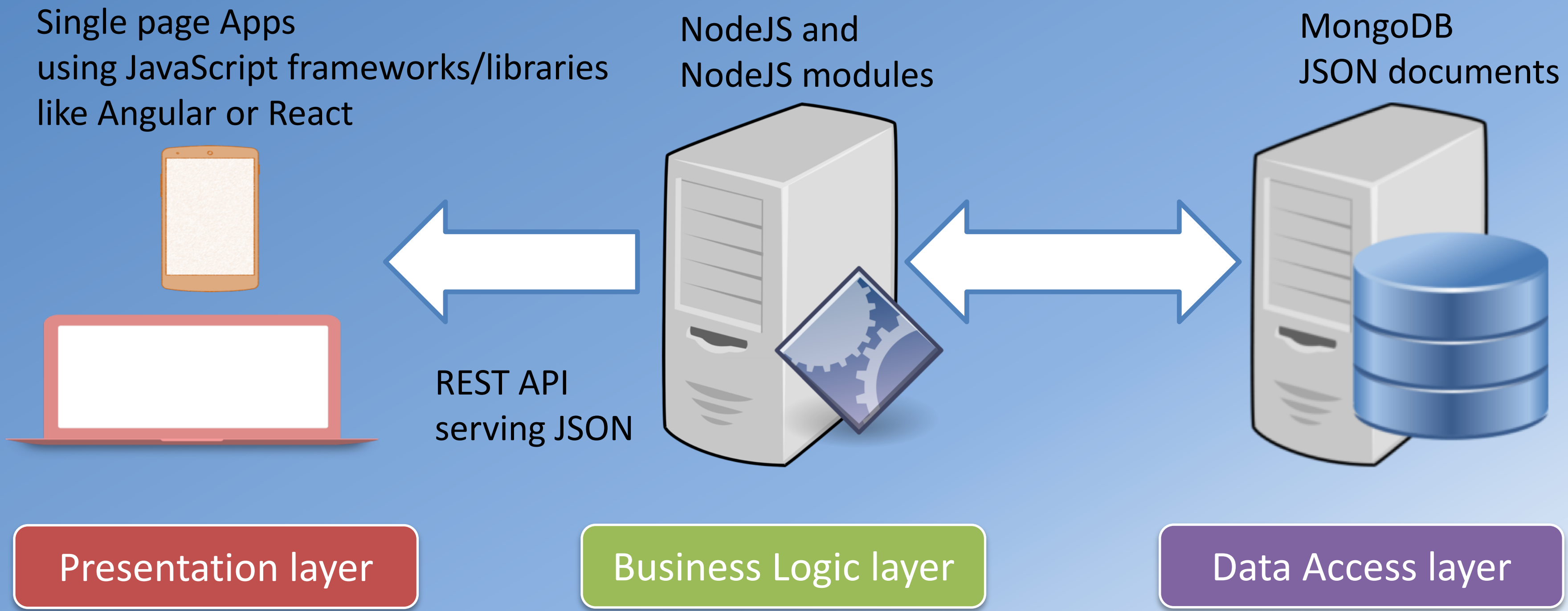
Server-side rendering

Presentation layer

Business Logic layer

Data Access layer

Full Stack JavaScript Development



Single page Apps
using JavaScript frameworks/libraries
like Angular or React

NodeJS and
NodeJS modules

MongoDB
JSON documents

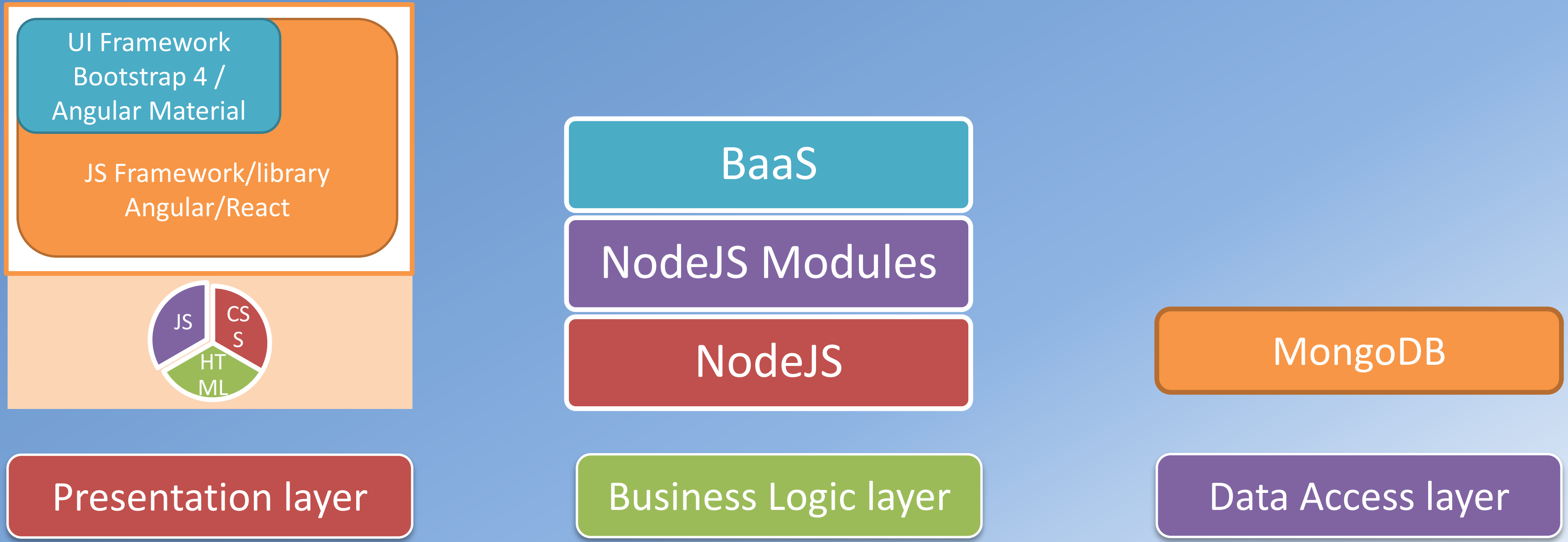
REST API
serving JSON

Presentation layer

Business Logic layer

Data Access layer

Full Stack Web Development



UI Framework
Bootstrap 4 /
Angular Material

JS Framework/library
Angular/React

JS

CS
S

HT
ML

BaaS

NodeJS Modules

NodeJS

MongoDB

Presentation layer

Business Logic layer

Data Access layer

Git

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Some Basic Concepts

- Version Control: software tool(s) that enable the management of changes to source code
  - Maintaining version history
- Several version control tools: CVS, SVN, Git etc.

Git

- Distributed version control system
- Developed by Linus Torvalds for managing Linux kernel development
- Widely adopted now by several projects
  - The Node ecosystem thrives on it

Exercises

- Setting up Git on your machine
- Using Git
- Using online Git repositories

Exercise: Setting up Git

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Exercise: Basic Git Commands

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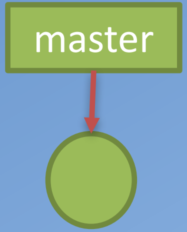
Basic Git Commands

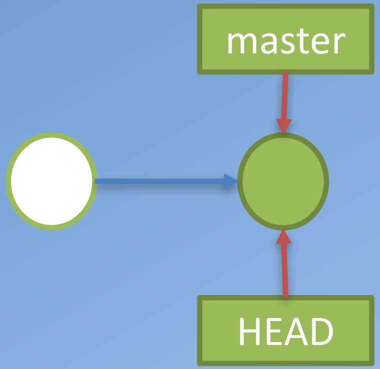
- git init
  - Initializes the current folder as a git repository



- git status
  - Current status of the folder

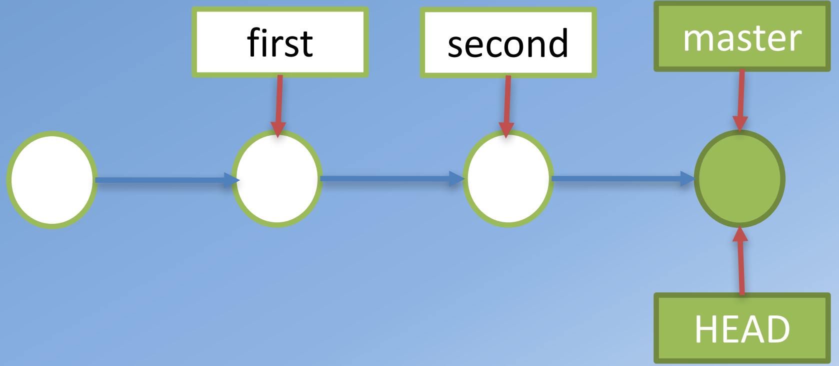
Basic Git Commands

- git add <file(s)/folder(s)>
  - add file(s)/folder(s)to staging area
- git commit
  - commit the changes to the git repository



Basic Git Commands

- git log –oneline
  - see a brief log of commits
- git checkout <commit> <file>
  - checkout the file from an older commit



Basic Git Commands

- git reset <file>
  - unstage a staged file, but leave working directory unchanged
- git reset
  - reset the staging area to the last commit without disturbing the working directory

Did you Git it?

Exercise: Online Git Repositories

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Online Git Repository

- Several online Git repository service providers:
  - GitHub (https://github.com)
  - Bitbucket (https://bitbucket.org)

Online Git Repository Commands

- git remote add origin <repository URL>
  - Add the remote online repository
- git push -u origin master
  - push the local git repository to the origin to the master branch

Online Git Repository Commands

- git clone <repository URL>
  - Clone an online Git repository to your computer

Did you finally Git it?

Node.js and NPM

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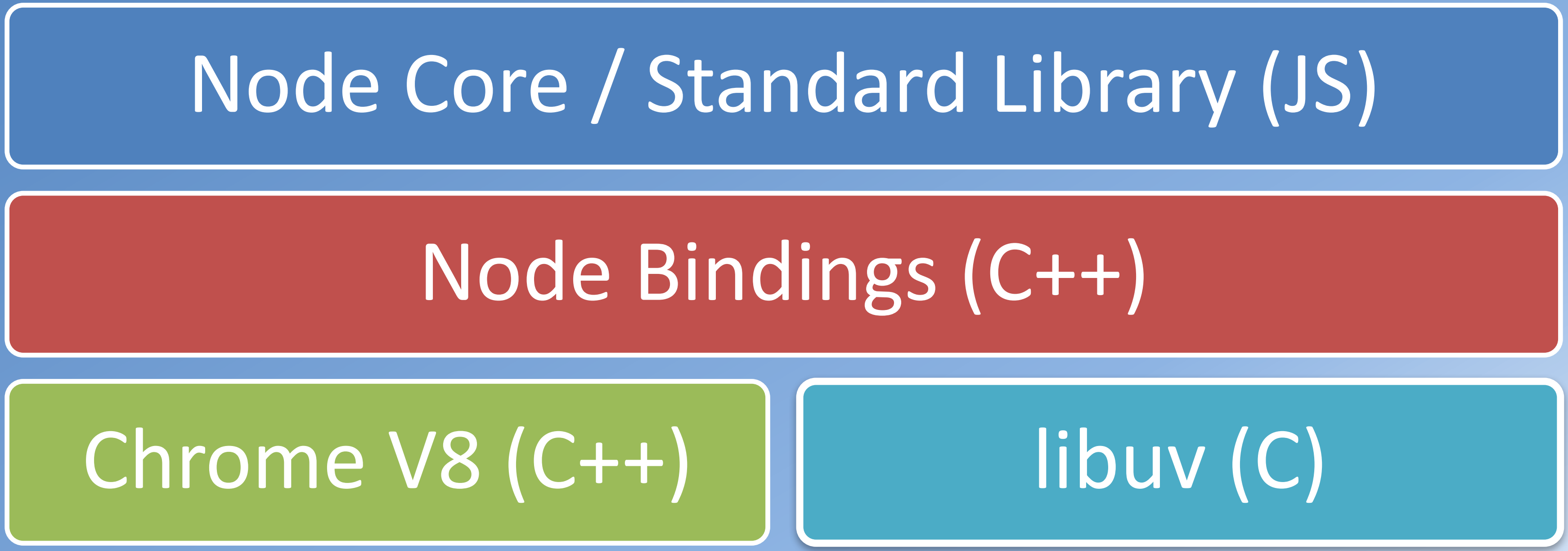
What is Node.js?

- JavaScript runtime built on Chrome V8 JavaScript Engine
- Uses an event-driven, non-blocking I/O model
  - Makes it lightweight and efficient
- At this moment, we will only talk about node's use as a JavaScript runtime
  - More on server-side use in a later course

Node Architecture



Node Core / Standard Library (JS)

Node Bindings (C++)

Chrome V8 (C++)

libuv (C)

Node.js Use Cases

- Utilities written in JavaScript for web development:
  - Bower, Grunt, Gulp, Yeoman etc.
- Server-side Development
  - Web server, Business logic, Database access

Node Package Manager

- Node package manager (NPM): manages ecosystem of node modules / packages
- A package contains:
  - JS files
  - package.json (manifest)

Exercise: Basics of Node.js and NPM

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package.json

- A package.json file affords you a lot of great things:
  - It serves as documentation for what packages your project depends on.
  - It allows you to specify the versions of a package that your project can use using semantic versioning rules.
  - Makes your build reproducible, which means that its *way* easier to share with other developers.

Source: https://docs.npmjs.com/getting-started/using-a-package.json

Initializing package.json

- To initialize a package.json file for your project, type at the prompt in your project directory:

```
npm init
```

  - follow along and answer the prompts to initialize

Front-End Web UI Frameworks: An Introduction

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Overview

- What are they?
- Why front-end frameworks?
- Popular front-end UI Frameworks

What are front-end UI frameworks

- Collection of ready-to-use HTML, CSS and JavaScript templates for UI components:
  - Typography, Forms, Buttons, Tables, Navigations, Dropdowns, Alerts, Modals, Tabs, Accordion, Carousel etc.

Popular front-end UI frameworks

1. Bootstrap
2. Semantic-UI
3. Foundation
4. Materialize
5. Material UI
6. Pure
7. Skeleton
8. UIKit
9. Milligram
10. Susy

https://www.keycdn.com/blog/front-end-frameworks/

Why Front-End Web UI Frameworks?

- Responsive web design
  - Mobile first
- Cross-browser compatibility
  - Dealing with quirks of browsers
- Increased productivity
  - Easy to get started
- Community support
  - Resources and web page templates

Introduction to Bootstrap

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Bootstrap Overview

Bootstrap is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web

- From the Bootstrap webpage

Bootstrap Overview

- Front-end framework for faster and easier web development
- Includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and many other, as well as optional JavaScript plugins
- Easily create responsive designs with mobile first approach

Bootstrap History

- First released in 2011
  - Mark Otto and Jacob Thornton
- Current Production Version 4.0
  - This course covers 4.0, but most classes still applicable to 3.3.7
- The first comprehensive framework
  - Gained popularity very quickly

Next

- Getting started with Bootstrap

Responsive Design

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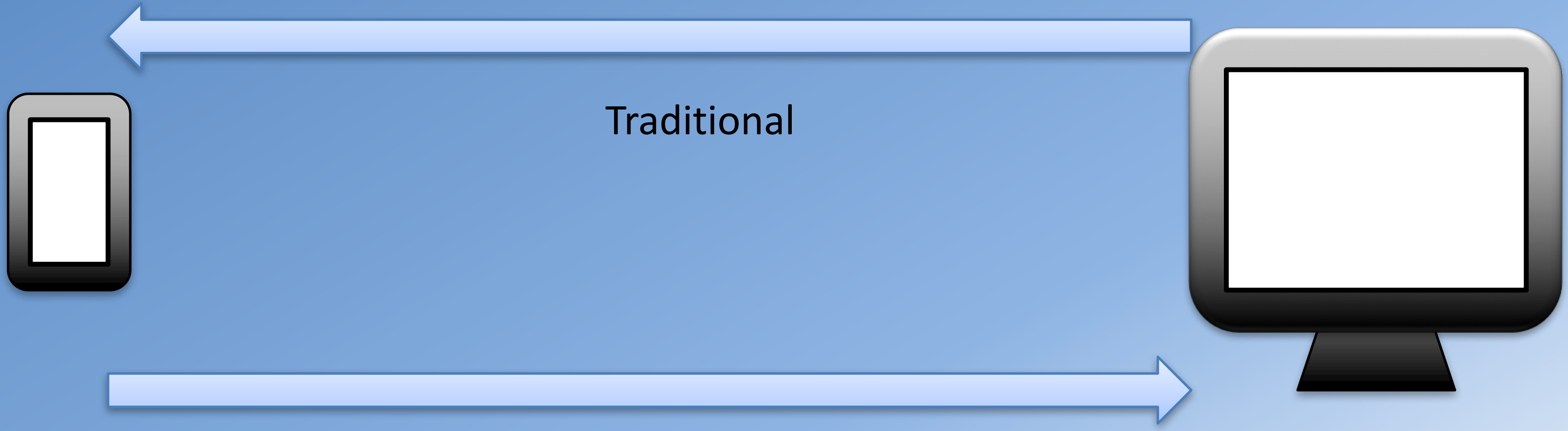
Why Responsive Design?

- Users increasingly accessing websites from a variety of devices of different screen sizes
- One size fits all no longer a possibility!
- Adapt to the user’s “viewport”
  - Build it into the core of the site

Mobile First Design



Traditional

Mobile first

First satisfy the
Mobile constraints

Foundation for Responsive Design

- Grid system
  - We’ll deal with Bootstrap Grid system next
- Fluid images
  - We’ll look at Bootstrap support later
- Media queries

Media Queries

- CSS technology to apply some styles based on the size of the viewport

e.g.,

```
@media (min-width: 992px) {
    /* CSS styles customized for desktop */
}
```

How do we do this?

- Start with a UI framework with responsive design built-in

Bootstrap Grid System

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Viewport

<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

- The *viewport* meta tag:
  - Ensures that the screen width is set to the device width and the content is rendered with this width in mind
  - Designing the websites to be responsive to the size of the viewport
    - Bootstrap grid system

http://getbootstrap.com/docs/4.0/layout/grid/

Bootstrap Grid

- Designed to be:
  - Responsive
  - Mobile first
  - Fluid

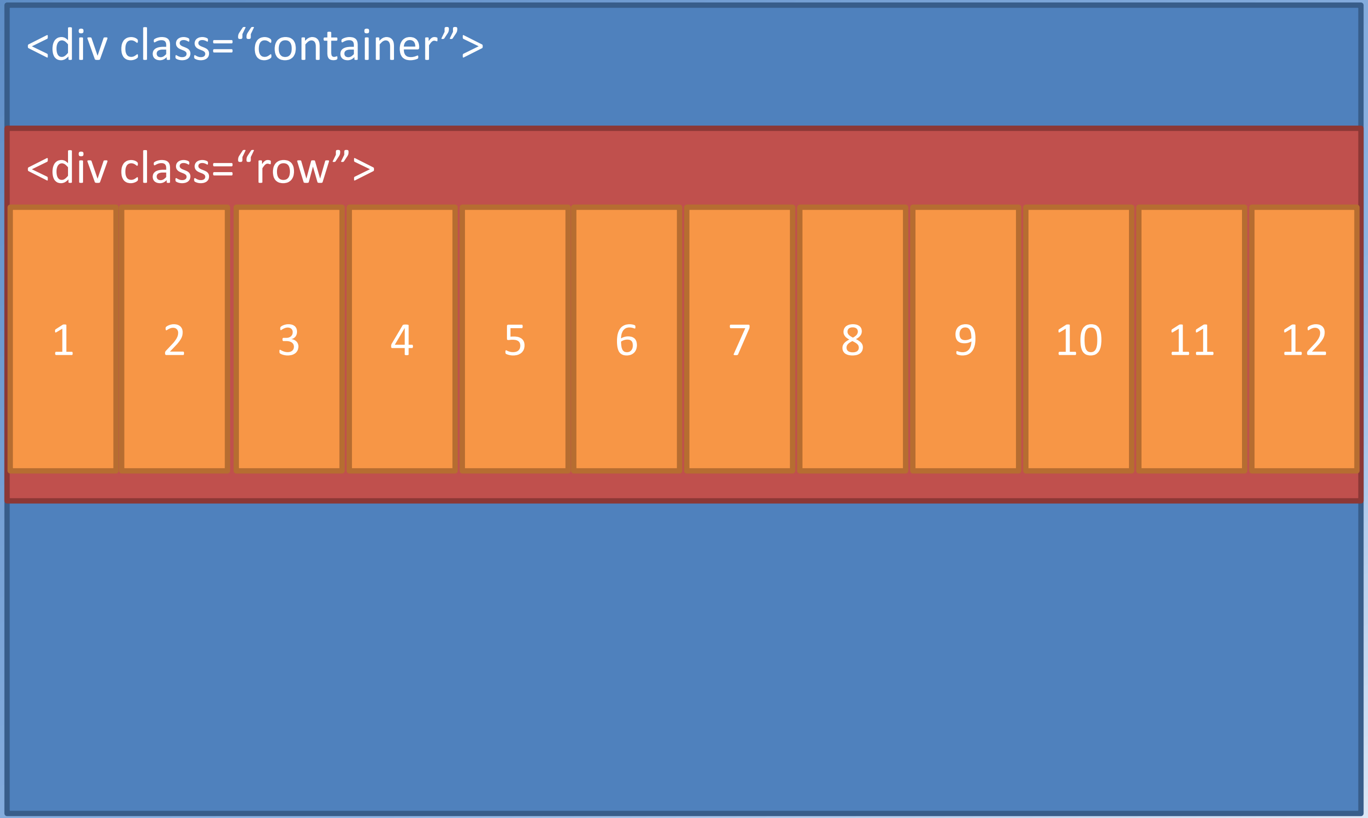
CSS Flexbox Layout

- Simpler and flexible layout options in CSS
- Can easily handle dynamic/unknown size of content containers
- Direction-agnostic layout

Why Flexbox for Bootstrap?

- Easy vertical alignment of content within a parent element
- Easy reordering of content across devices and screen resolutions with the help of media queries
- Easy CSS-only equal height columns for your grid-based layouts

Bootstrap Grid



<div class=“container”>

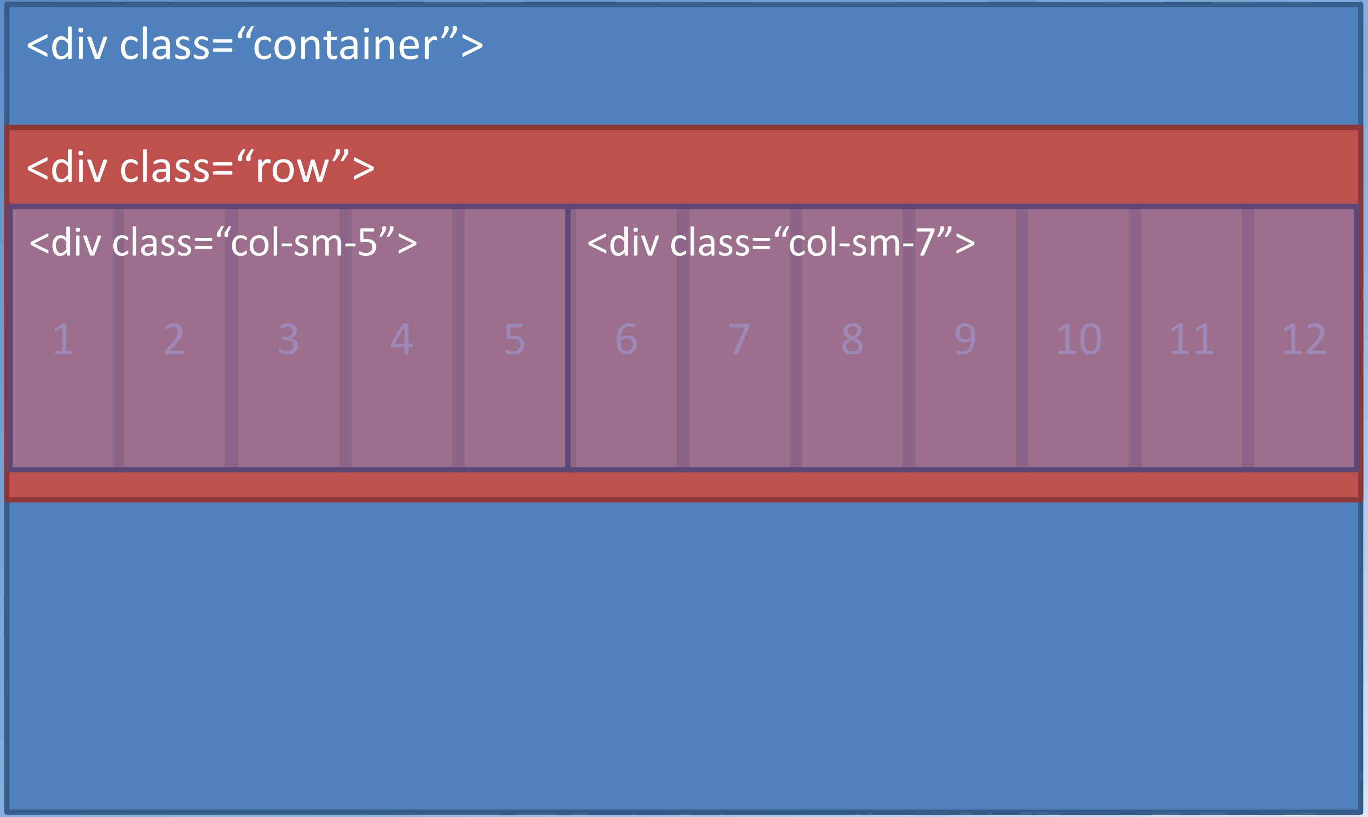
<div class=“row”>

1 2 3 4 5 6 7 8 9 10 11 12

Bootstrap Grid

- Bootstrap makes available five classes
  - default targets all screen sizes from extra small to extra large*,*
  - *sm* for small,
  - *md* for medium,
  - *lg* for large, and
  - *xl* for extra large screen sizes
- Each row in Bootstrap grid system is divided into 12 columns
- Use the classes .col-*, .col-sm-*, col-md-*, and .col-lg-* for defining the layouts for the various screen sizes
- Specify how many columns each piece of content will occupy within a row, all adding up to 12 or a multiple thereof

Bootstrap Grid



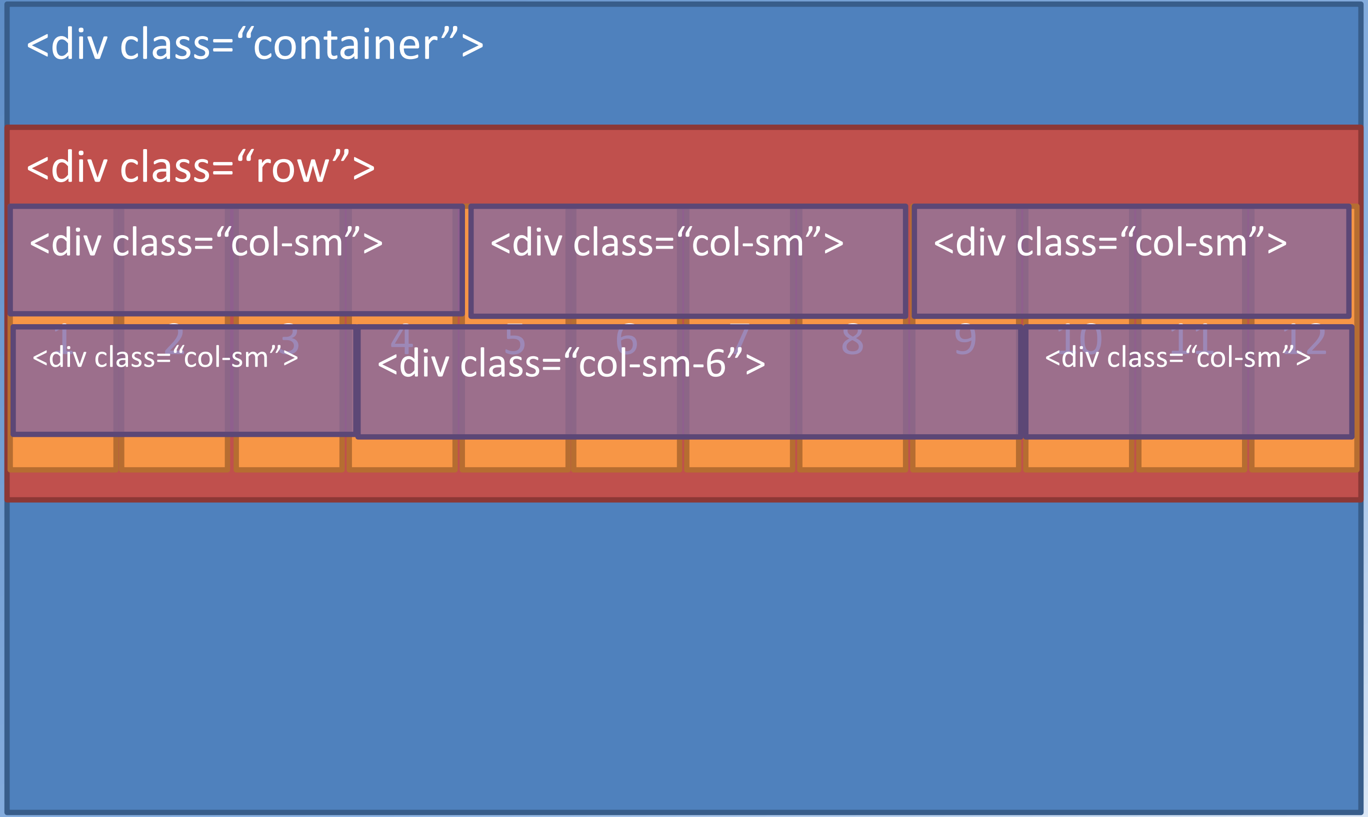
<div class="container">

<div class="row">

<div class="col-sm-5">

<div class="col-sm-7">

Auto-layout Columns



<div class="container">

<div class="row">

<div class="col-sm"> <div class="col-sm"> <div class="col-sm">

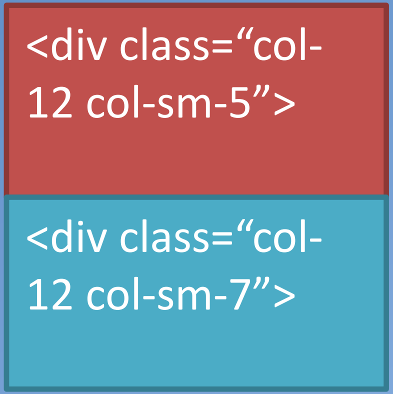
<div class="col-sm"> <div class="col-sm-6"> <div class="col-sm">

Bootstrap Grid Details

	Extra small <576px	Small ≥576px	Medium ≥768px	Large ≥992px	Extra large ≥1200px
Grid behavior	Horizontal at all times	Collapsed to start, horizontal above breakpoints			
Max container width	None (auto)	540px	720px	960px	1140px
Class prefix	.col-	.col-sm-	.col-md-	.col-lg-	.col-xl-
# of columns	12				
Gutter width	30px (15px on each side of a column)				
Nestable	Yes				
Offsets	Yes				

Using Column classes

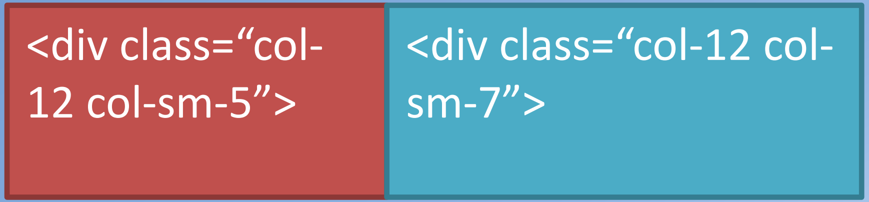
Extra Small Screens



<div class="col-12 col-sm-5">

<div class="col-12 col-sm-7">

Small, Medium, Large and Extra Large Screens

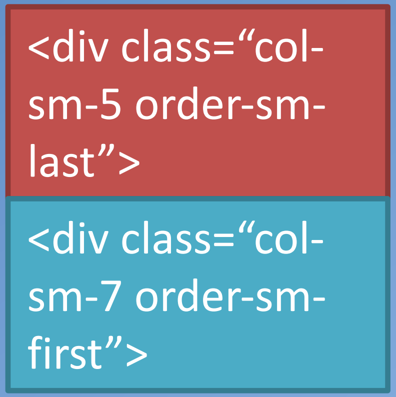


<div class="col-12 col-sm-5">

<div class="col-12 col-sm-7">

Reordering Content

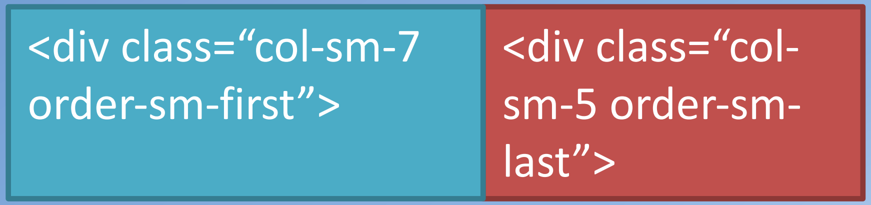
Extra Small Screens



<div class="col-sm-5 order-sm-last">

<div class="col-sm-7 order-sm-first">

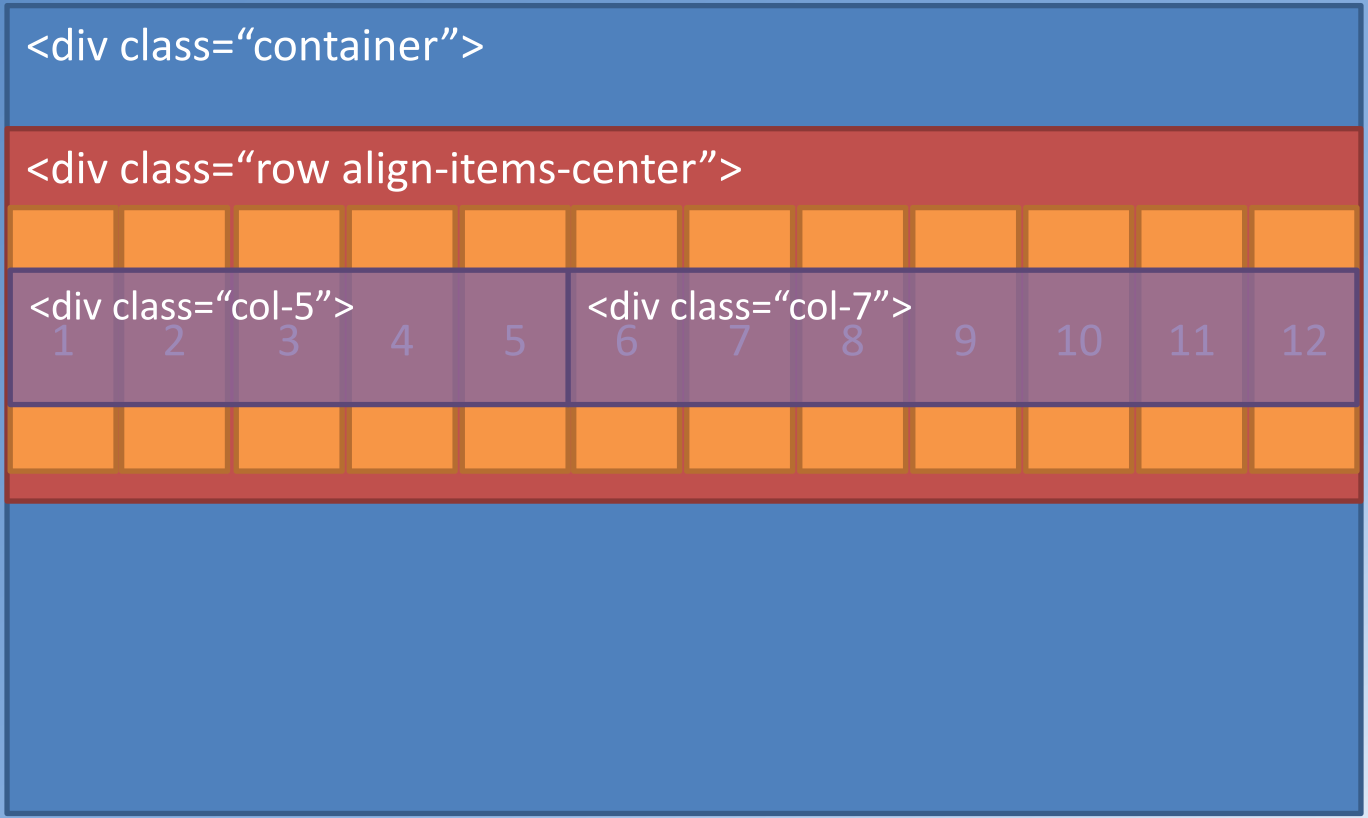
Small, Medium and Large Screens



<div class="col-sm-7 order-sm-first">

<div class="col-sm-5 order-sm-last">

Vertical Alignment



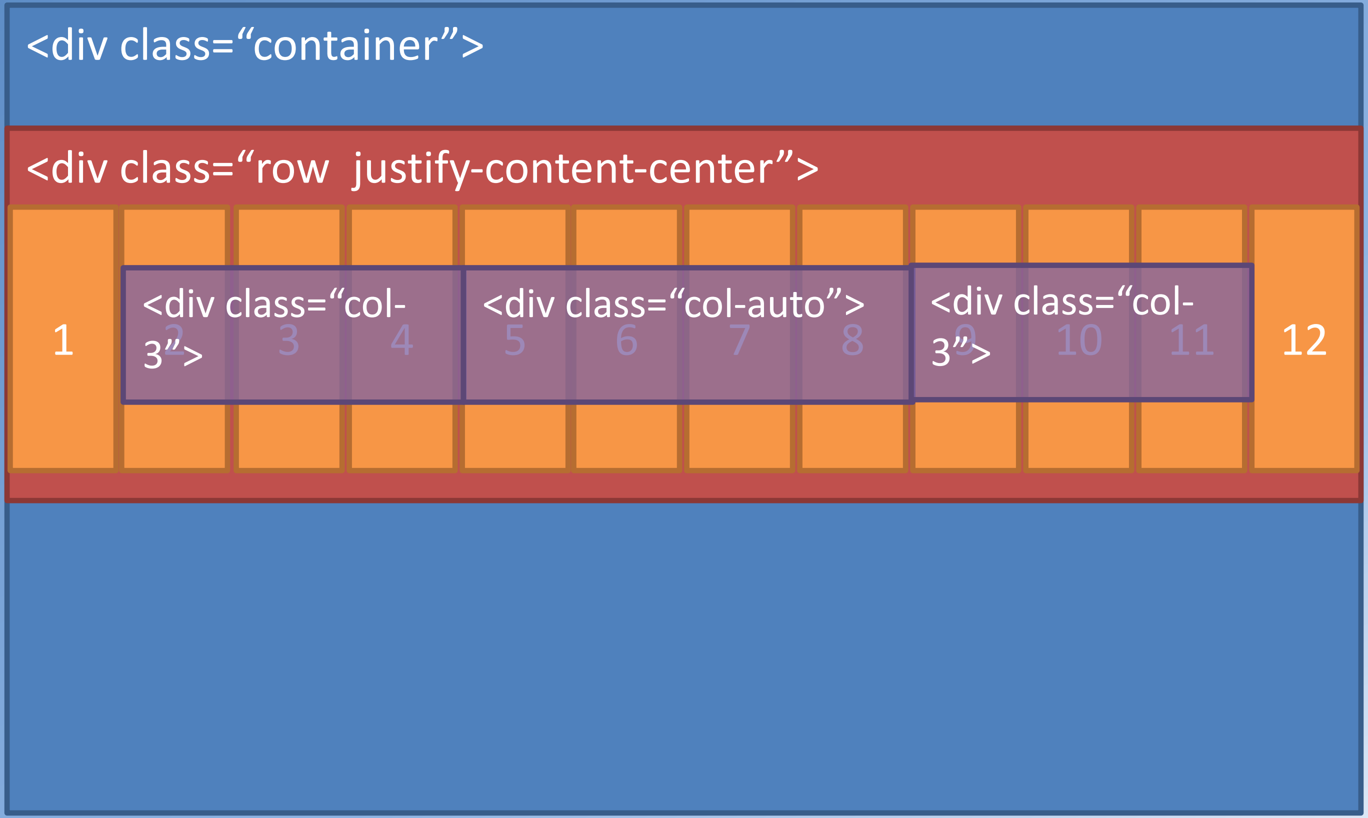
<div class=“container”>

<div class=“row align-items-center”>

<div class=“col-5”>

<div class=“col-7”>

Horizontal Alignment



<div class="container">

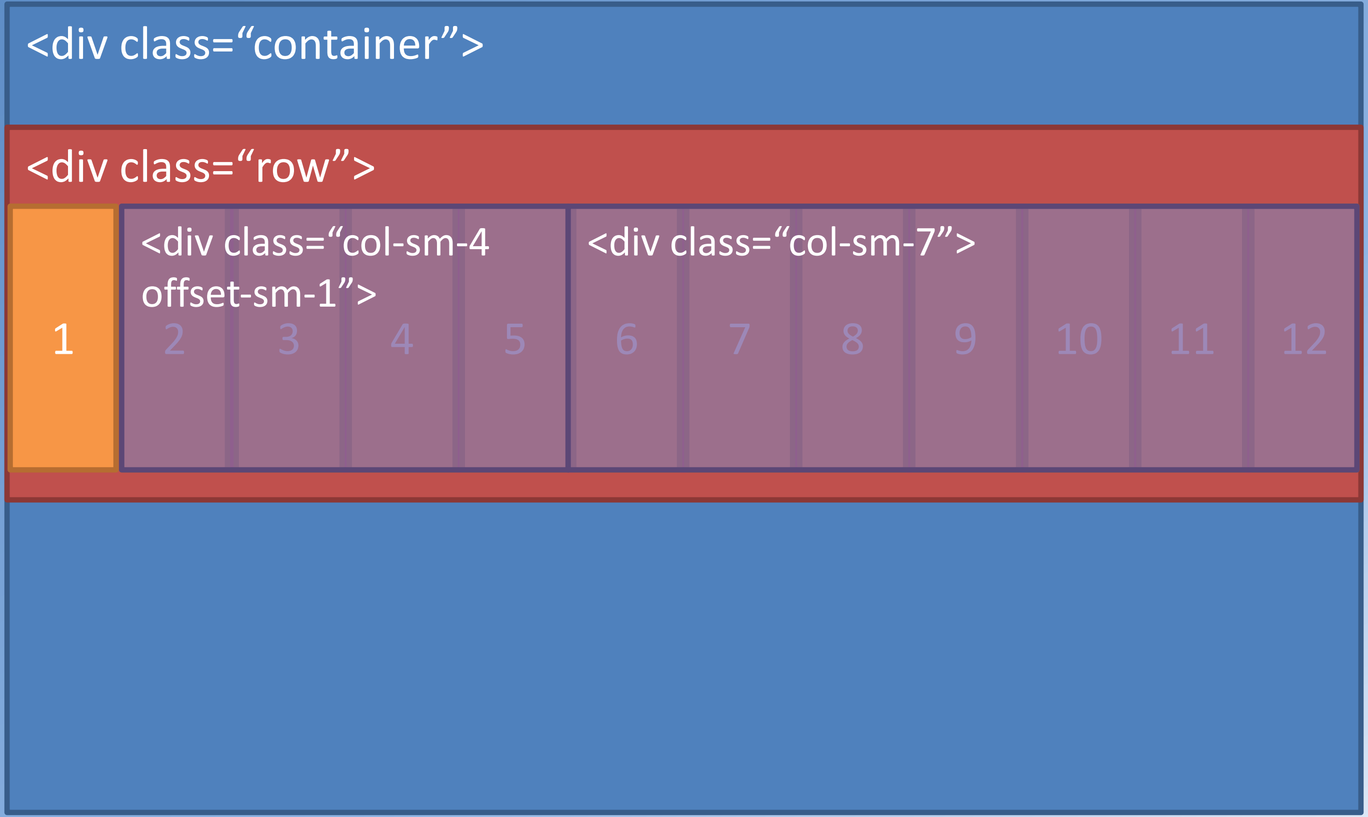
<div class="row justify-content-center">

<div class="col-3">

<div class="col-auto">

<div class="col-3">

Column Offsets



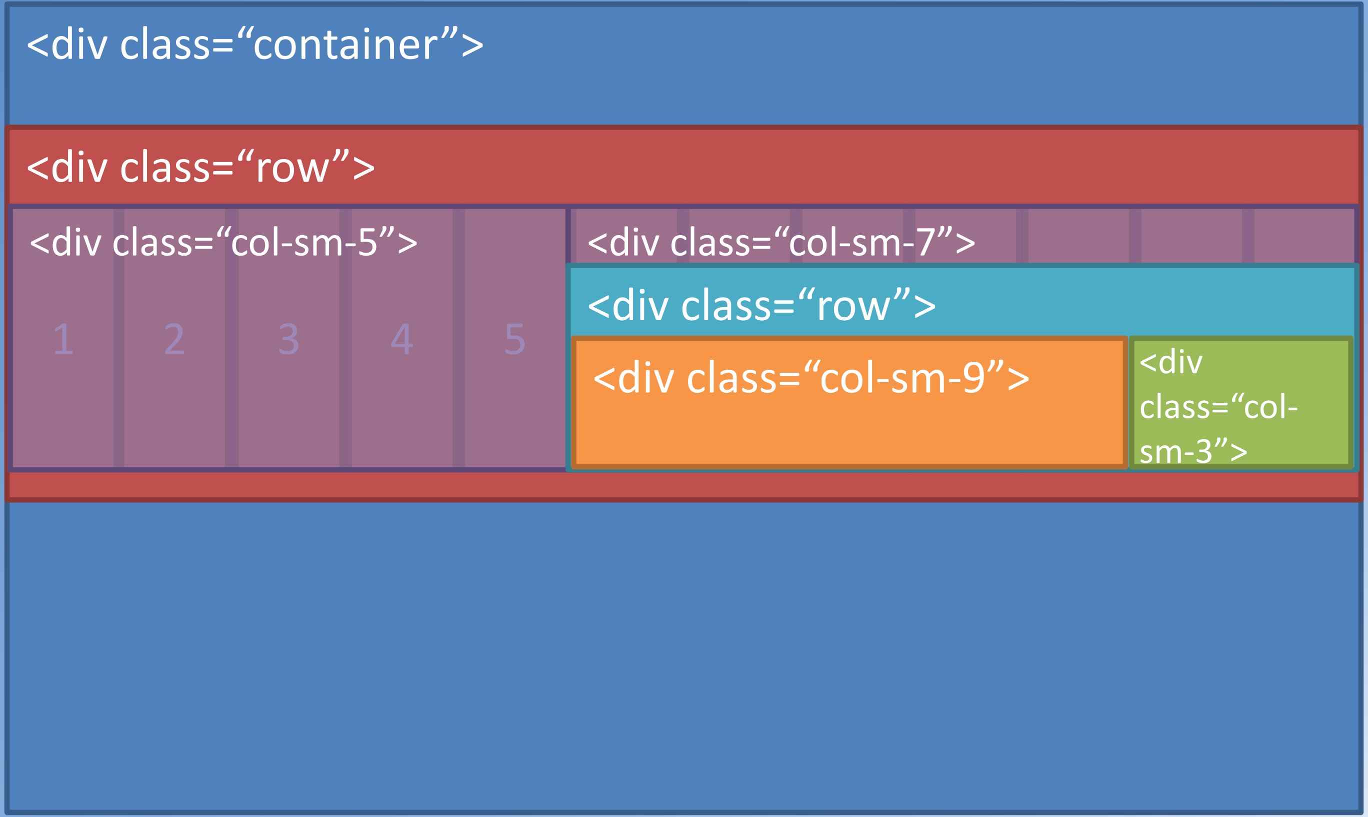
<div class=“container”>

<div class=“row”>

<div class=“col-sm-4 offset-sm-1”>

<div class=“col-sm-7”>

Nesting Columns



<div class=“container”>

<div class=“row”>

<div class=“col-sm-5”>

1 2 3 4 5

<div class=“col-sm-7”>

<div class=“row”>

<div class=“col-sm-9”>

<div class=“col-sm-3”>

Exercise: Responsive Design and Bootstrap Grid System

- Create responsive websites using the Bootstrap grid system
- Customize the CSS classes through your own additions in a separate CSS file