CSS

Responsive Design, Media Queries, Grid System

Floats, Flexbox, CSS Grid

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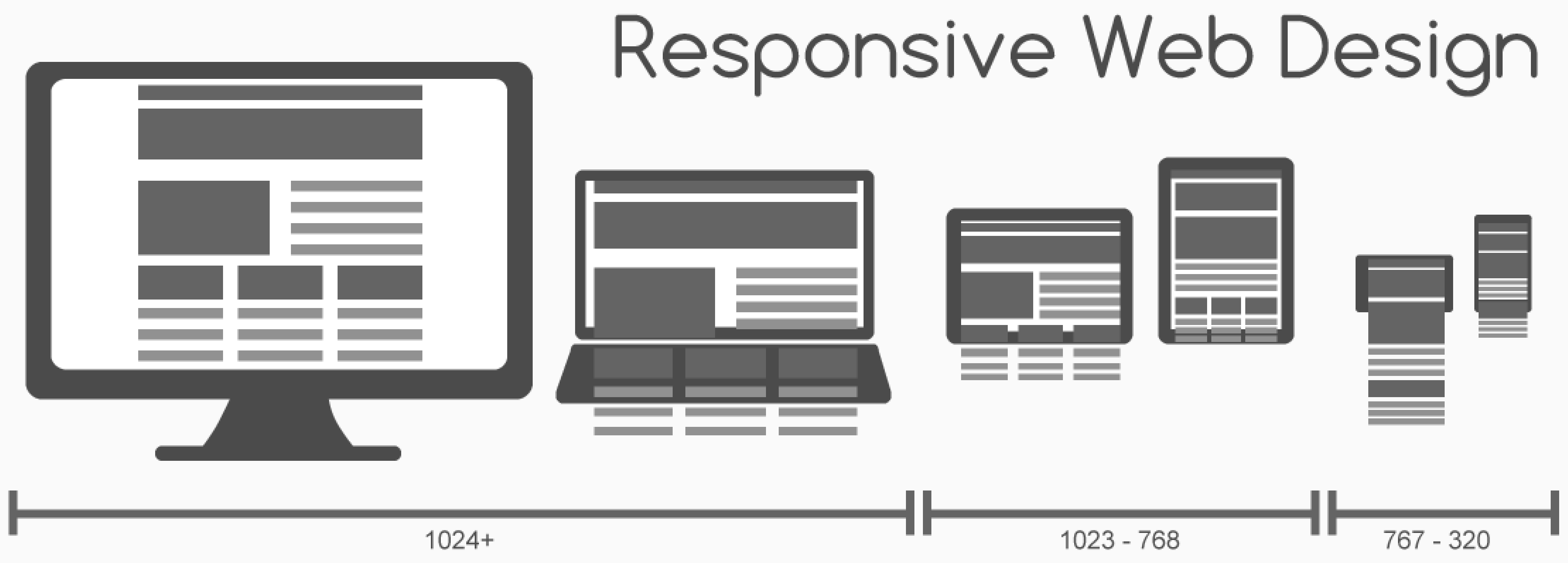
Motivation

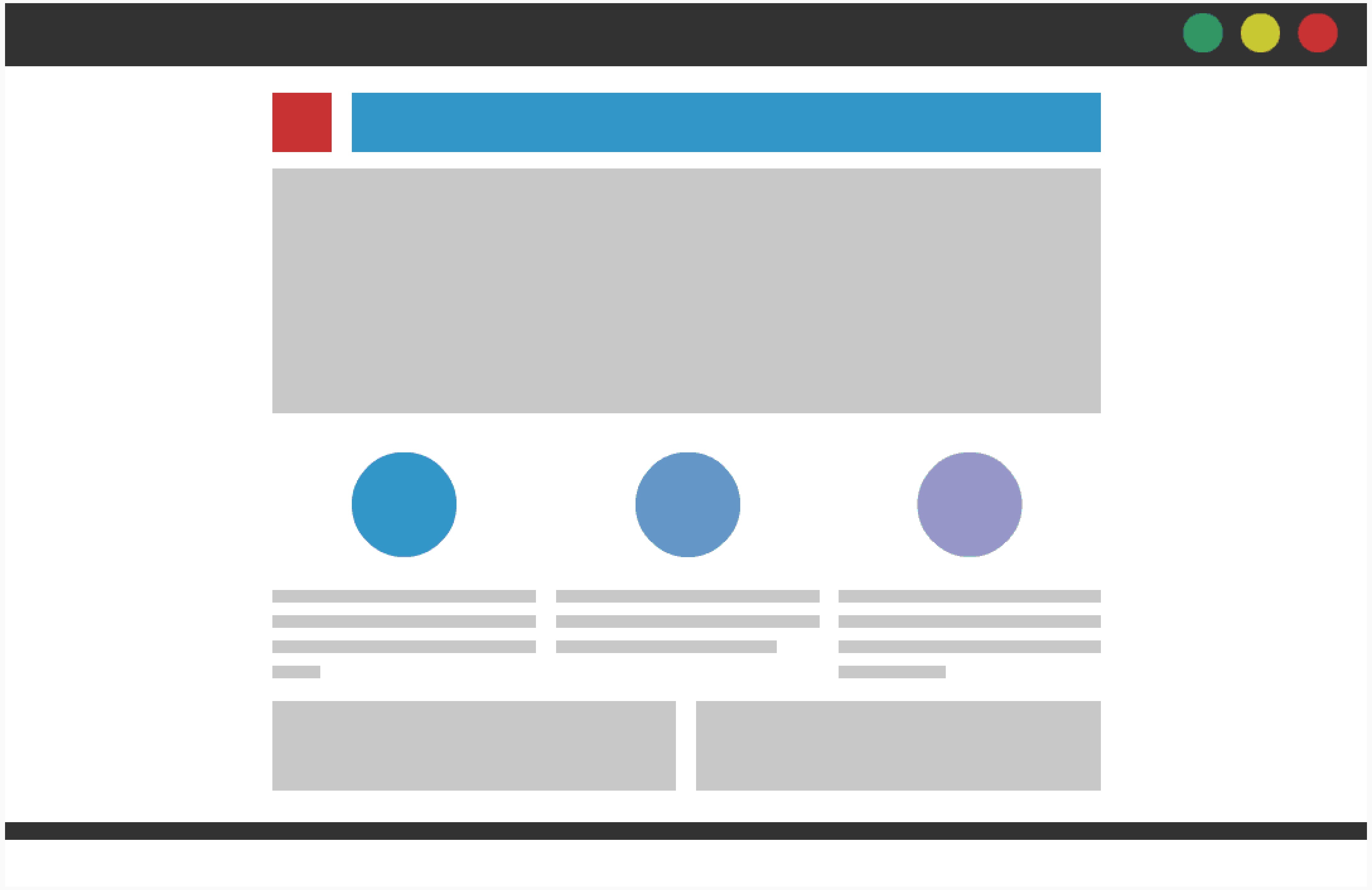
- adjust the document to devices with different resolutions
  - mobile devices, tablets, laptops, standard monitors, …
  - statistics…



fixed × fluid × adaptive × **responsive** layout

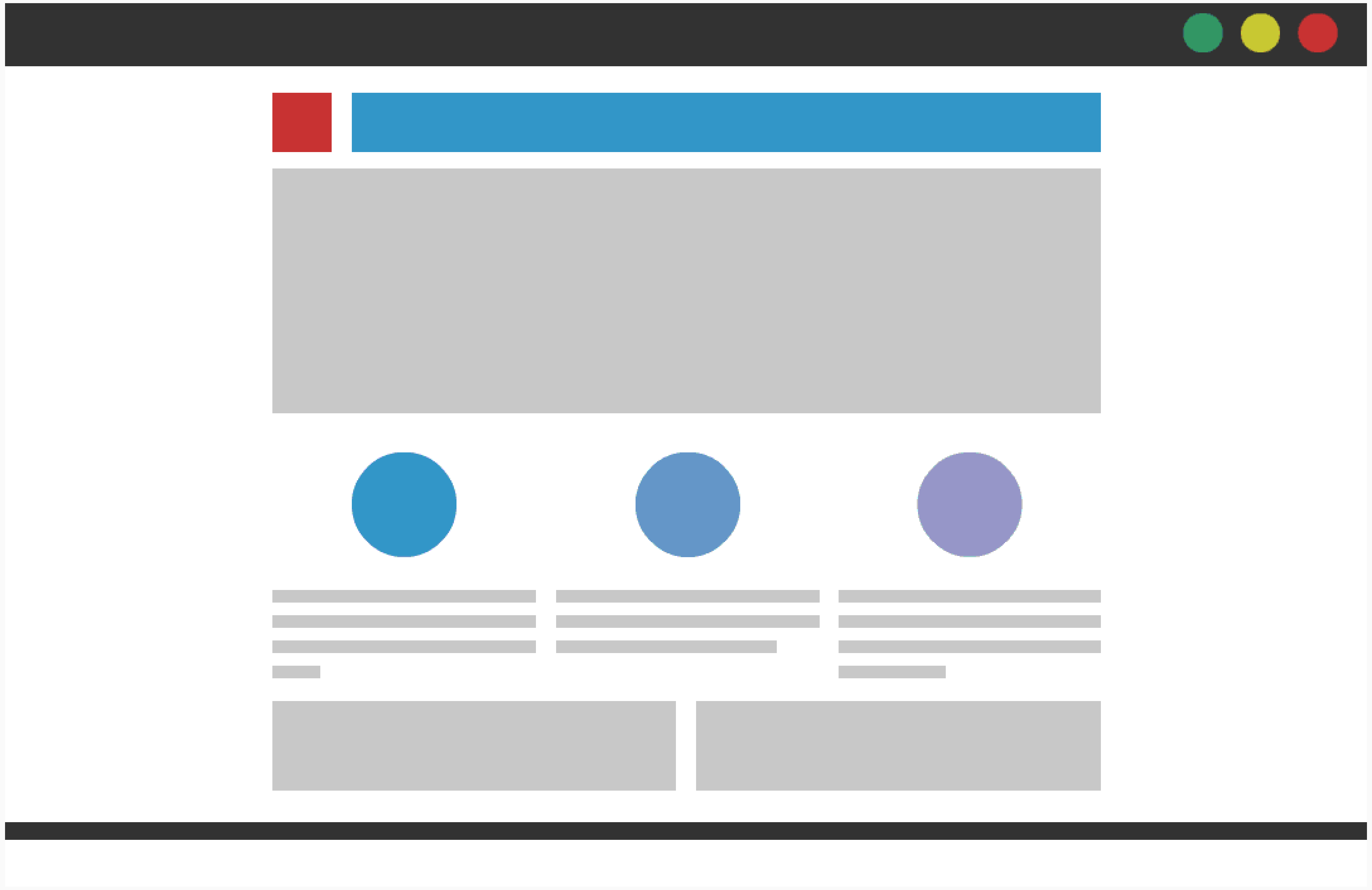
Fluid layout

- width expressed in percentages



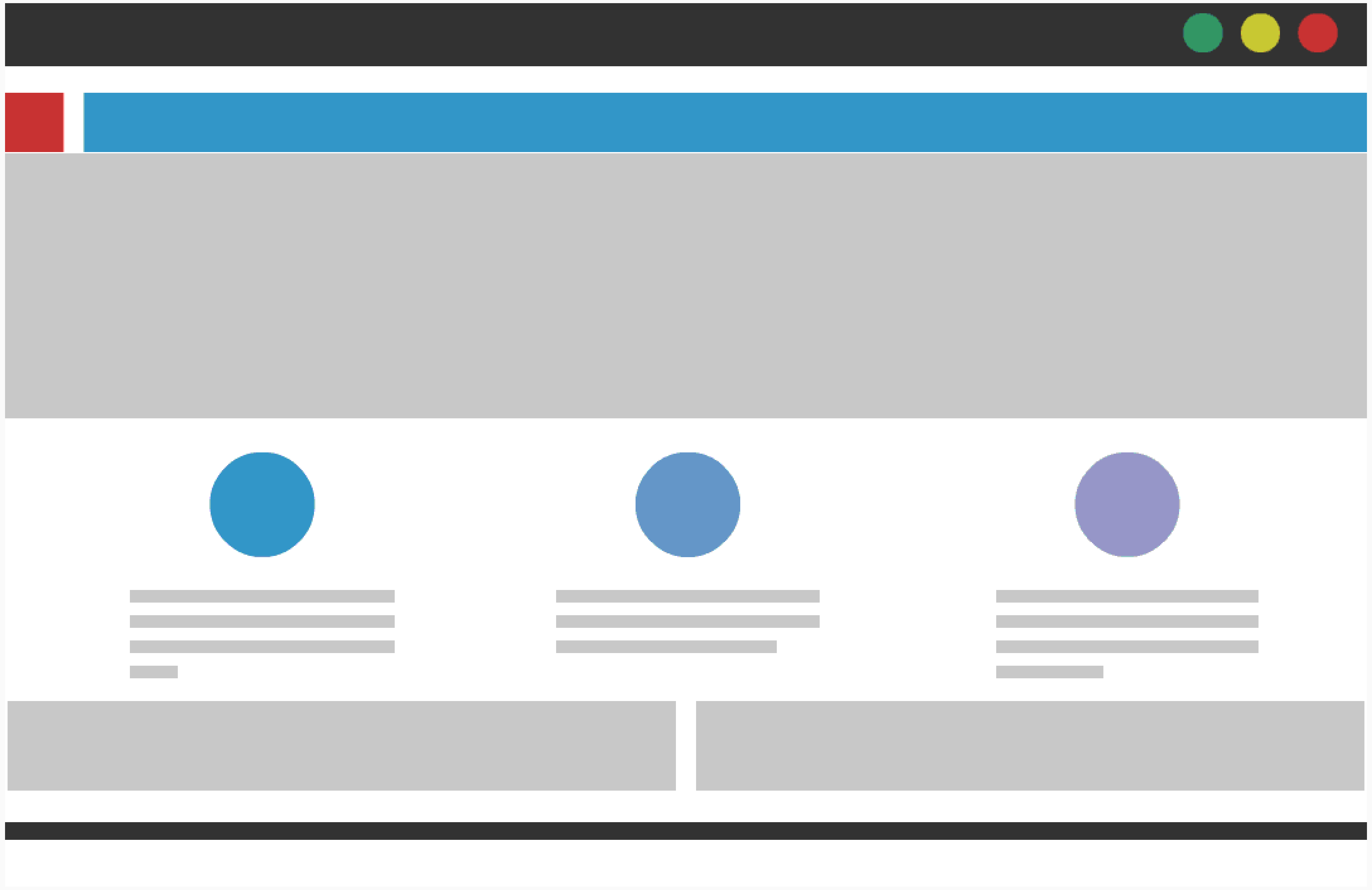
Adaptive layout

- contains so-called breakpoints



Responsive layout

- combination of fluid and adaptive layout

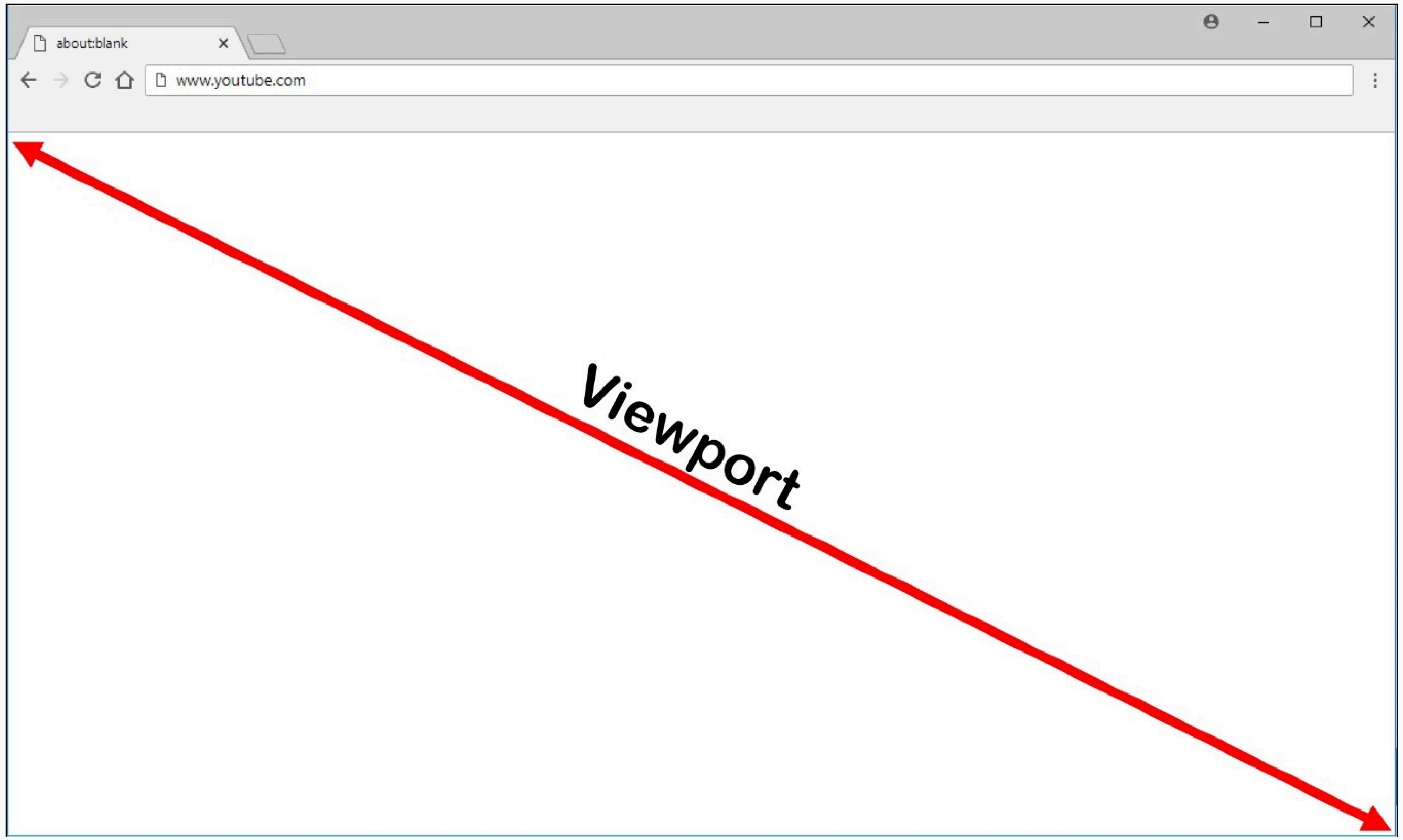


Introduction, Terms

Viewport, Media Queries, Breakpoints, Grid System

Viewport

- the visible part of the document, generally depends on the browser window size



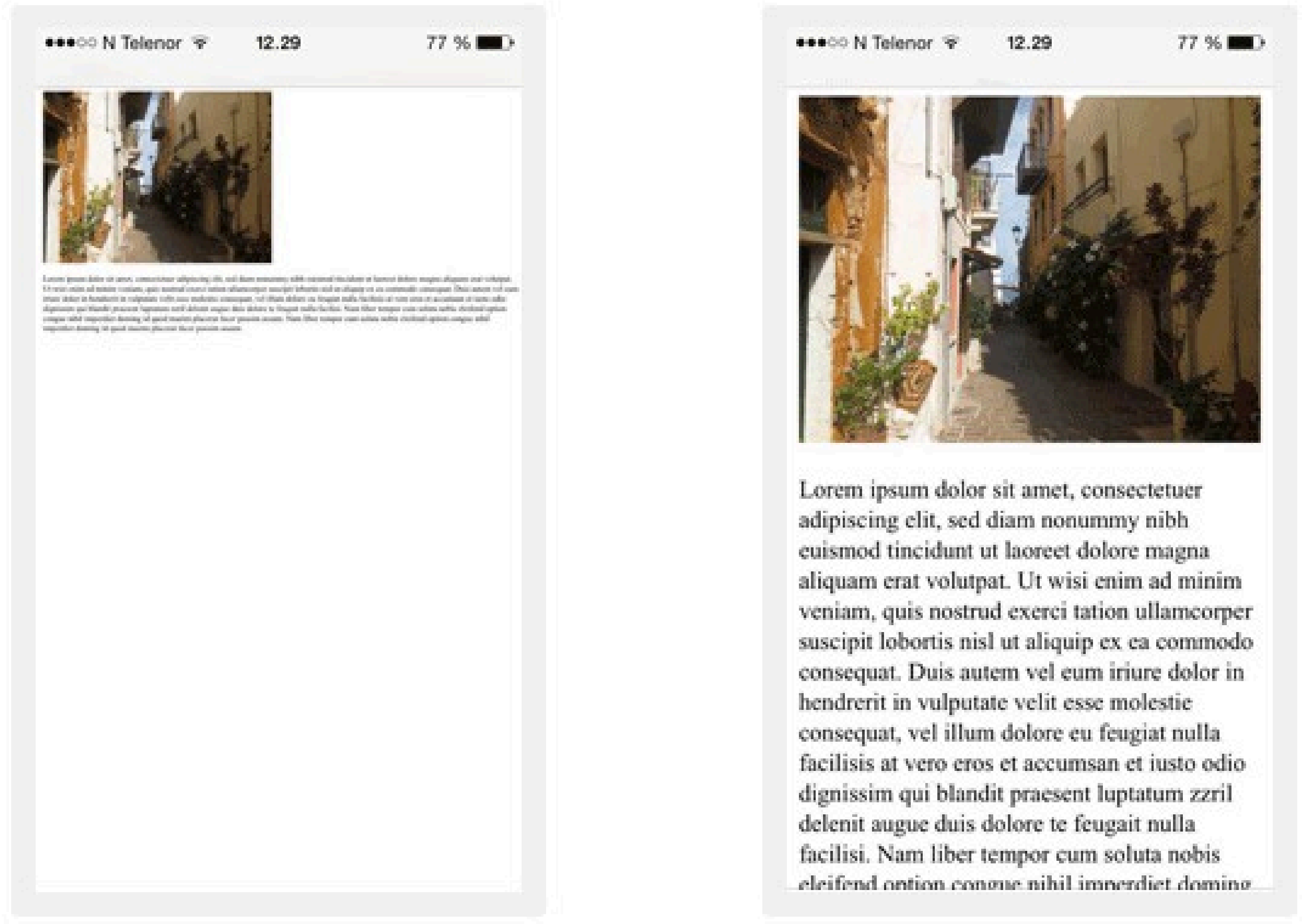
- we are particularly interested in the **available width** (horizontal scrolling is not user-friendly)

Viewport: Mobile Devices

- mobile device browsers have a viewport width larger than their resolution
  - an issue for responsive design

- it is necessary to adjust the HTML document header:

```html
<head>
  <meta name="viewport"
    content="width=device-width,
         initial-scale=1">
</head>
```



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Without the viewport meta tag **With the viewport meta tag**

Design Process

1. design the layout (visual element arrangement) of the document
   starting with mobile devices: (approach *mobile first*)
   - the document usually consists of a single column made up of blocks whose width is relative (usually 100% – full width, possibly with some padding/margin)
   - avoid large fixed-width elements

2. design the document layout **for higher resolutions:**

- dynamically rearrange blocks into multiple columns (floats, flex, grid, …) at higher resolutions
- **CSS3 Media Queries**

Media Queries

- use the **`@media`** rule for conditional style definitions
- CSS3 Media Queries (W3C recommendation)

```
@media not|only mediatype and (expressions) {
  /* CSS rules */
}
```

- **`not`**: negates the entire rule
- **`only`**: older browsers will ignore the construction
- **`mediatype`**: type of media/device
  - `screen`, `print`, `speech`, `all`, …
- **`expressions`**: conditions for the rule (screen size, …)

Media Queries: Conditions and Breakpoints

- **`min-width`**, **`max-width`**, `orientation`, other expressions…
- Media Queries allow limiting (so-called **breakpoints**) the application of rules to specific screen resolutions:

```css
/* extra small screen rules */

@media only screen and (min-width: 576px) {
  /* small screen rules */
}

@media only screen and (min-width: 768px) {
  /* medium screen rules */
}

@media only screen and (min-width: 992px) {
  /* large screen rules */
}

/* etc… */
```

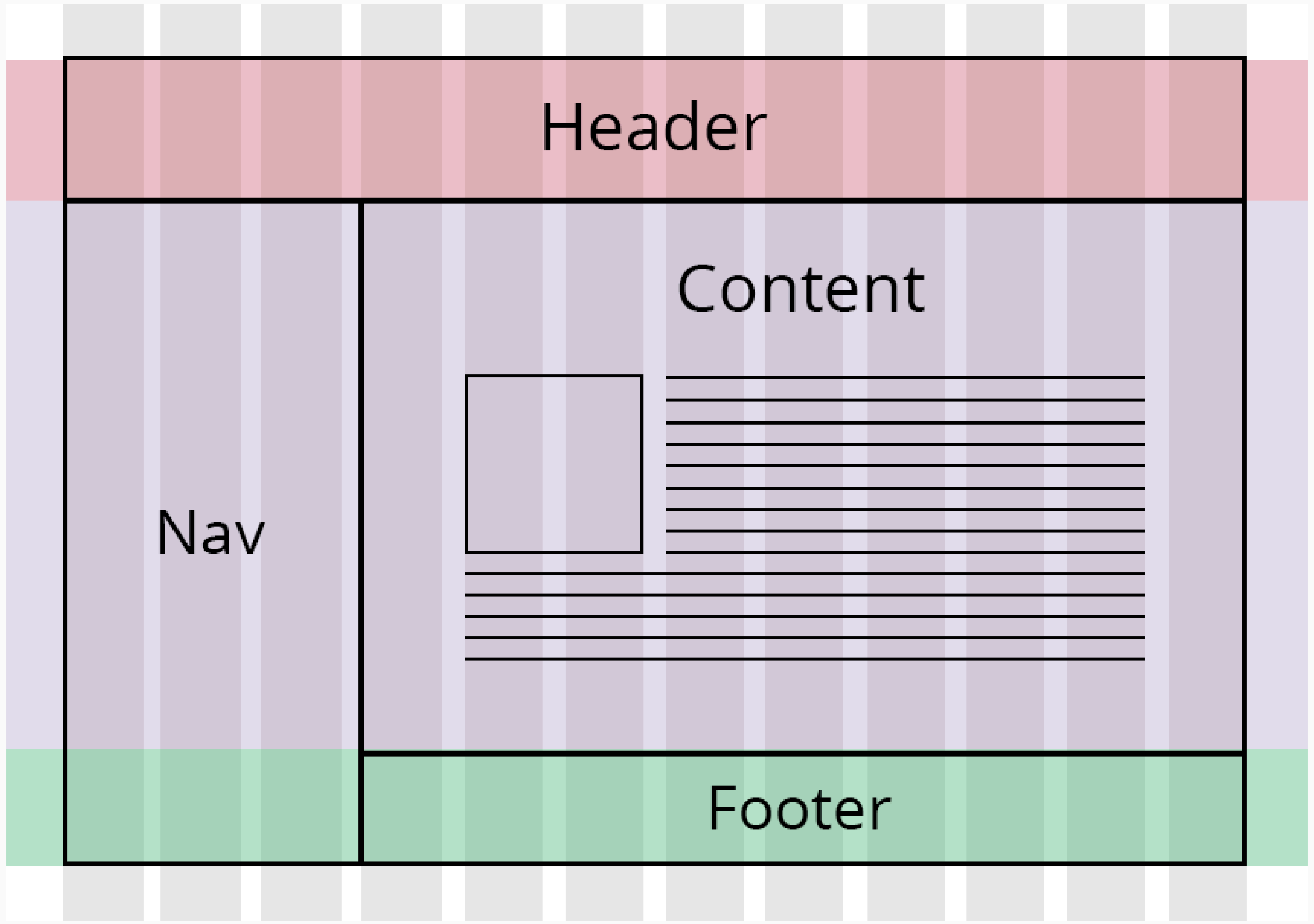
Bootstrap Breakpoints

Breakpoint	Class Prefix	Width
Extra small	none	<576px
Small	`sm`	≥576px
Medium	`md`	≥768px
Large	`lg`	≥992px
Extra large	`xl`	≥1200px
Extra extra large	`xxl`	≥1400px

Grid System

- a technique for organizing elements into a grid consisting of ***n* columns**
  - often **12** – easily divisible, but generally any number

- easier design
- easier implementation
- better organization of elements on the page
- content is perceived better by users



Grid System: Implementation

- it is necessary to address the problem of horizontal positioning of blocks:
  - **floats** (used, for example, in Bootstrap 3)
  - **Flexbox** (used, for example, in Bootstrap 4)
  - **CSS Grid** – an advanced method for creating layouts

- it is **recommended to combine** approaches depending on the specific problem
  - positioning elements in a single row vs. into a grid, etc.

Grid System: Floats

1. Rows

- blocks will be positioned into columns on rows – class **.row**

- necessary to address **issues with floating elements:**
  - clear: both – breaking floating (float) blocks after each row:

```
.row::after {
    content: "";
    clear: both;
}
```

  - overflow: hidden – some columns in a row may have a smaller height than the resulting row height (columns of the next row could overlap the previous row):

```
.row {
    overflow: hidden;
}
```

2. Columns

- elements will be organized into columns within a row:
- necessary to define classes for columns of different widths:

```
[class*="col-"] { float: left; }

.col-1 { width: 25%; } /* 1/4 */
.col-2 { width: 50%; } /* 2/4 */
.col-3 { width: 75%; } /* 3/4 */
.col-4 { width: 100%; } /* 4/4 */
```

  - the **`float`** property causes elements to float and align side by side
  - the **`width`** property determines how much space a column will relatively occupy in a row
  - the number of columns can be chosen to best suit the specific problem
  - a 12-column layout is often used (easily divisible)

2. Columns: HTML

- classes will be assigned to elements in the HTML document based on the desired layout:

```html
<div id="content" class="row">
  <div id="sidebar" class="col-1">
    <!-- 1/4 -->
  </div>
  <div id="article" class="col-3">
    <!-- 3/4 -->
  </div>
</div>
```

```
     sidebar
1/4
```

Example

3. Breakpoints

- use **Media Queries** for breakpoints for different browser window (viewport) widths
  - e.g., Bootstrap breakpoints, …

```
/* Small devices – default display */
[class*="col-"] { float: left; width: 100%; }

/* Medium devices (tablet) */
@media only screen and (min-width: 768px) {
  .col-md-1 { width: 25%; }
  .col-md-2 { width: 50%; }
  …
}

/* Large devices (PC) */
@media only screen and (min-width: 1200px) {
  .col-lg-1 { width: 25%; }
  .col-md-2 { width: 50%; }
  …
}
```

3. Breakpoints: HTML

- classes will be assigned to elements in the HTML document based on the desired layout for different width groups:

```html
<div id="content" class="row">
  <div id="sidebar" class="col-md-2 col-lg-1">
  </div>
  <div id="article" class="col-md-2 col-lg-3">
  </div>
</div>
```

sidebar

Example

4. Border and Padding

- often, we want to set some **`padding`** or **`border`** for blocks positioned into columns

```
border: 0
padding: 0
```

```
Lorem ipsum dolor sit amet, consectetur adipiscing elit.
```

```
Lorem ipsum dolor sit amet, consectetur adipiscing elit.
```

Actual box width = `margin` + `border` + `padding` + `width`

Example

Summary

- a way to create a Grid system when Flexbox and Grid were not available

- **disadvantages**:
  - need to set `overflow` and `clear` properties
  - column height may not fill the row height
  - floating elements are generally better suited for text wrapping, not layout creation
  - gaps between columns must be handled using `padding`

- Solution: **Flexbox**

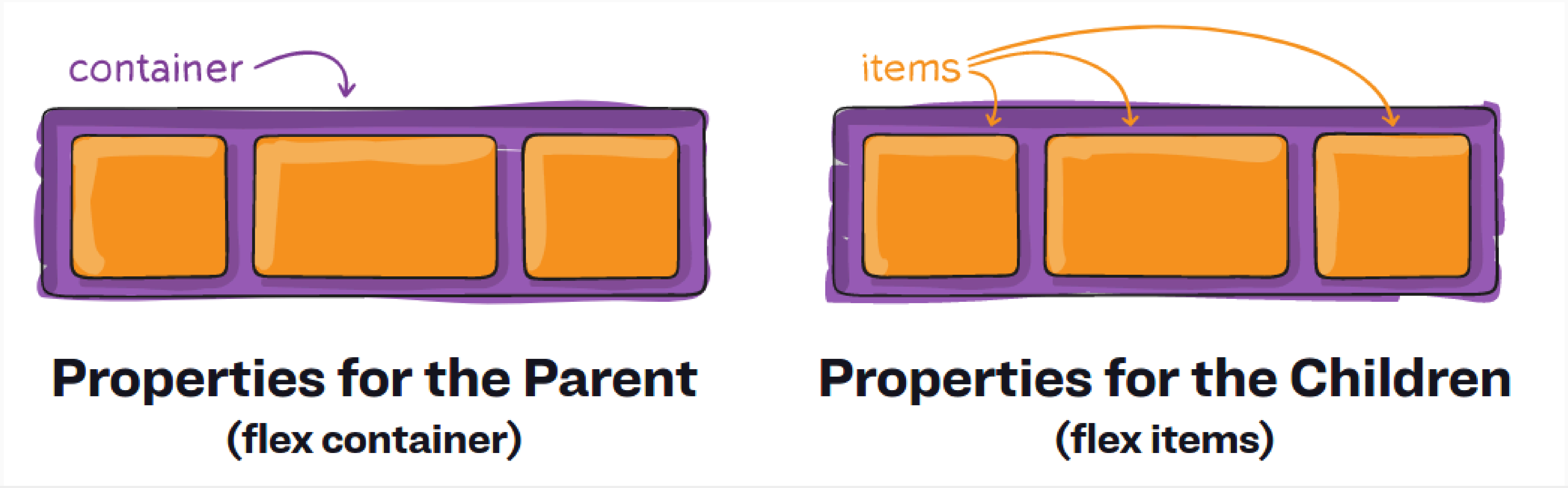
Grid System: Flexbox

Flexbox

- a tool for arranging elements in one dimension (row/column)
  - covered in lecture CSS – Page Layout

- the layout consists of:

1. **containers** (*flex container*)
2. **container items** (*flex items*)



1. Flex Container: Row

- a parent element that contains other elements we want to position within the container

```
.row {
  display: flex;

  flex-direction: row; /* setting the main axis - row orientation
                    not necessary to set, default value */

  flex-wrap: wrap; /* items will wrap if they overflow */

  align-items: stretch; /* alignment of items on the cross axis
                     row items will occupy the full height of the row */
}
```

2. Flex Container Items: Columns

```
[class*="col-"] {
  flex-basis: 100%; /* base size */
  flex-grow: 1; /* width growth will be even for all columns */
  flex-shrink: 1; /* width reduction will be even for all columns */
}

@media only screen and (min-width: 768px) {
  .col-sm-1 { flex-basis: 25%; }
  .col-sm-2 { flex-basis: 50%; }
  .col-sm-3 { flex-basis: 75%; }
  .col-sm-4 { flex-basis: 100%; }
}

/* etc… */
```

All Together

body

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Example

Summary

- especially useful when positioning elements within one dimension (e.g., in a row)
  - compared to floats, it offers additional properties (e.g., `align-items`, `gap` …)

- responsiveness can be achieved in alternative ways:
  - using the `wrap` property combined with `min-width` – items will wrap when the page width decreases
  - defining `flex-grow` and `flex-shrink` properties for each element individually + combining with Media Queries
  - …

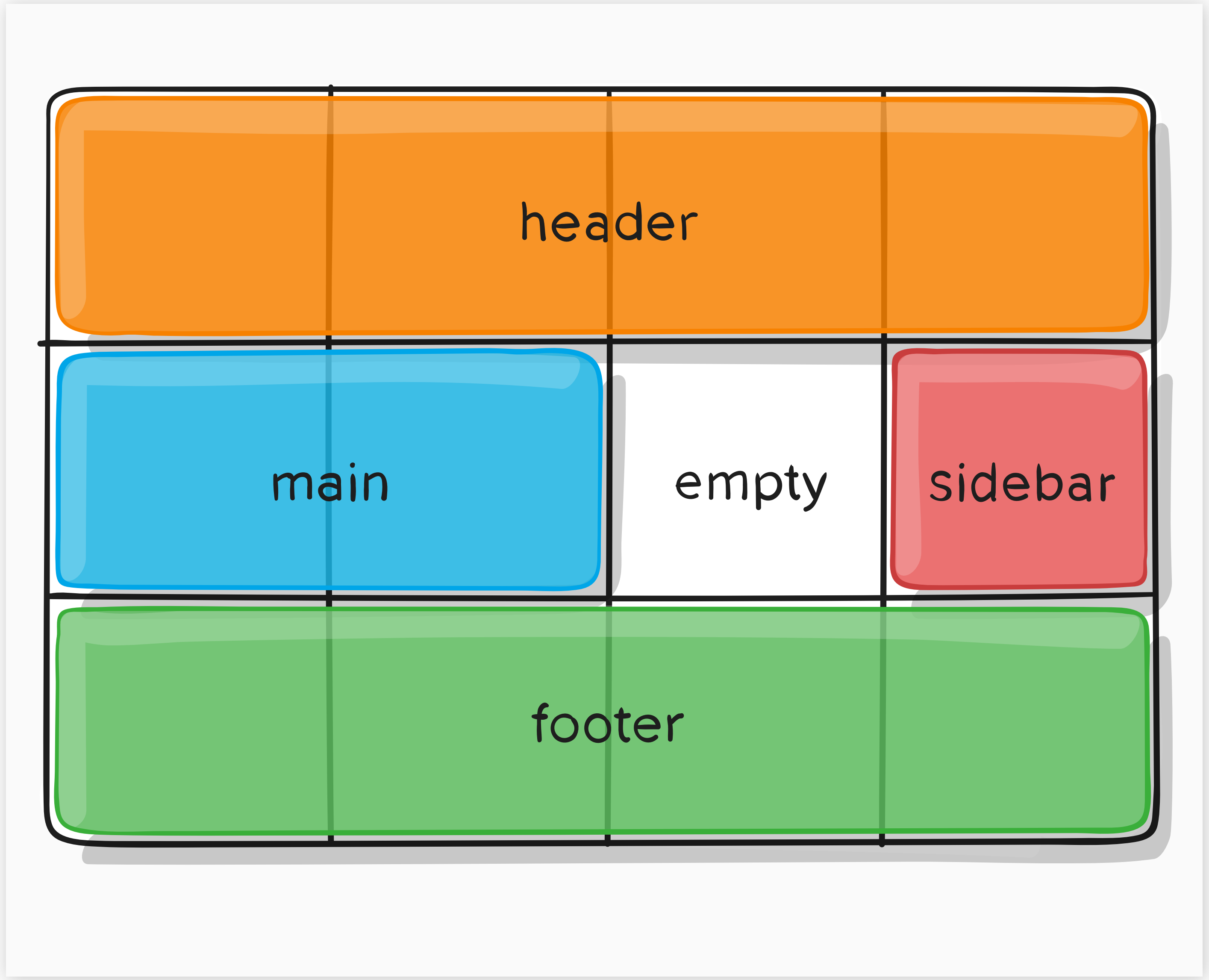
- **disadvantages**
  - still necessary to wrap row elements in a separate container
  - the Grid system uses utility classes in HTML (`row`, `col-`)
  - solution: **CSS Grid**

Grid System: CSS Grid

CSS Grid

- a tool for arranging elements in two dimensions (rows + columns)
  - covered in lecture CSS – Page Layout
- the most advanced tool for arranging elements in CSS so far
- allows easy definition of a Grid system without modifying the HTML document

- the layout consists of:
  1. **container** (*grid container*)
     - contains a grid (*grid*) made up of cells (*cells*)
     - groups of cells form tracks or areas (*tracks*, *areas*), which map to container items (*grid items*)
  2. **container items** (*grid items*)
     - elements (direct children) of the container



1. Grid Container: Layout

- the parent element that forms the grid
- we choose a layout strategy using **`grid-template-areas`**

```css
.container {
  display: grid;

  grid-template-columns: repeat(4, 1fr); /* 4-column layout */

  grid-template-areas: "header header header header"
              "sidebar content content content";
              /* custom naming of areas - creating the layout itself */
}
```

header

header

Example

2. Grid Container Items

```
header {
  grid-area: header;
}

nav {
  grid-area: sidebar;
}

article {
  grid-area: content;
}
```

```
<div class="container">
  <header>header</header>
  <nav>nav</nav>
  <article>article</article>
</div>
```

```
header

header
```

Example

3. Responsive Grid

```
.container {
  display: grid;
  grid-template-columns: 1fr;
  grid-template-areas: "header"
              "sidebar"
              "content";
}
@media only screen and (min-width: 768px) {
  .container {
  grid-template-columns: repeat(2, 1fr);
  grid-template-areas: "header header"
              "sidebar content";
  }
}
@media only screen and (min-width: 1200px) {
  .container {
  grid-template-columns: repeat(4, 1fr);
  grid-template-areas: "header header header header"
              "sidebar content content content";
  }
}
```

3. Responsive Grid

body

- About the Course
- Schedule
- Lectures

Example

Responsive Grid Without Media Queries

```css
.container {
  display: grid;
  grid-template-columns: repeat(auto-fit, minmax(300px, 1fr) minmax(300px, 1fr));
  gap: .5rem;
}
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Curabitur tempus

Example

Summary

- CSS Grid provides advanced options for arranging elements
  - compared to Flexbox, it allows 2D arrangement (rows + columns) – complete layout definition
  - no need to define a container for each row
  - no need to use utility classes in the HTML document (`row`, `col-`)

Summary

links

Key Information

- **Responsive layout** = fluid + adaptive layout
- **Viewport** – visible part of the document (browser window)
- **Grid system** – technique for organizing elements into a grid consisting of n columns (12)
- **Mobile first** approach – design the layout for small widths first, then progressively for larger ones
- **Media Queries**
- **breakpoints**
- **floats** vs. **Flexbox** vs. **CSS Grid**
  - these approaches are not mutually exclusive; it is often appropriate to combine them depending on the specific situation

- **it is important to try everything out practically**
- tutorial:
  - https://www.w3schools.com/css/css_rwd_intro.asp

To be continued…

CSS3, frameworks