L4: CSS Responsive Design

Web Engineering
188.951 2VU SS20

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L4: CSS Responsive Design

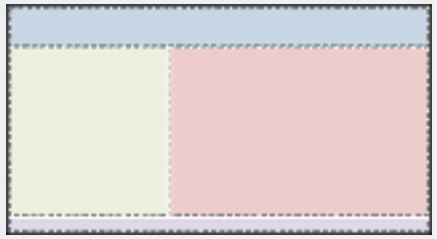
- Media Queries
- Responsive and Adaptive Images and Fonts
- Flexible Box Layouts (Flexbox)
- Grid Layouts

Learning Goals

- Differentiate between different options to achieve responsive layouts
- Understand how images and fonts can be made
- Properly use media queries for responsive design
- Understand the role of Flexbox and Grid layouts

Web Layout Approaches

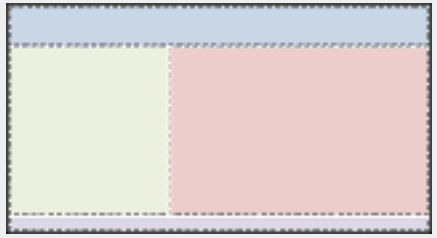
Responsive Design is a way of implementing web layouts based on current standards, HTML5 and CSS3.



Interface A

Interface B

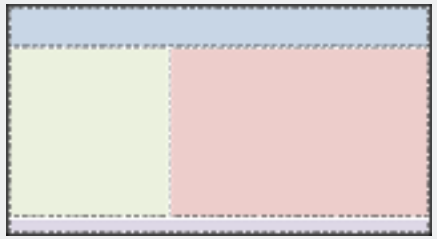
Graceful degradation



Interface A

Interface B

Mobile-first / Progressive enhancement



Interface A

Interface B

Responsive design

Slides by Michael Nebeling and the work by Michael Nebeling and Moira C. Norrie: Responsive Design and Development: Methods, Technologies and Current Issues, In: Proc. 13th Intl. Conf. on Web Engineering (ICWE 2013), LNCS, vol. 7977, pp. 510-513. Springer, 2013.

Responsive Design

Let content fill the container and define min/max constraints

Use relative units to specify position and size of text and media

Techniques

- Media Queries
- Fluid, Grid-based Layout
- Responsive Images
- Font Scaling
- …

Required Reading:
http://alistapart.com/article/responsive-web-design/

Media Queries

- Previously only media types (screen, print, braille, handheld …)
- @media rule
- Additional features
  - color
  - aspect-ratio
  - max-width
  - orientation
  - resolution
  - scan
  - …
- Build complex queries using logical operators (not, and, only)

```
@media only screen and (max-width: 500px) { … }
@media tv and (min-width: 700px) and (orientation: landscape) { … }
<!-- comma acts as 'or' -->
@media (min-width: 700px), handheld and (orientation: landscape) { … }
```

Viewport
The virtual “window”

Viewport

- Visible area of webpage
- Size content to viewport
- Avoid horizontal scrolling
- Avoid necessity to zoom

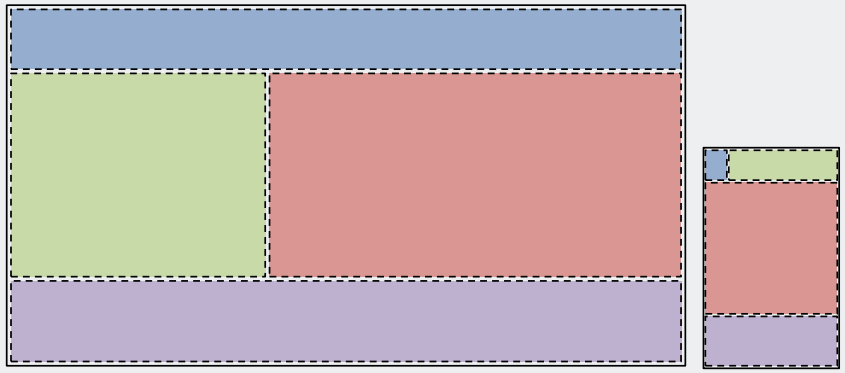
- Control viewport in HTML5
  - Through meta-element

- Consider mobile
  - Sometimes narrower/wider
  - Prevent default shrinking

```
<meta name="viewport"
      content="width=device-width,
               initial-scale=1.0,
               maximum-scale=3,
               minimum-scale=0.5" />
```

https://developer.apple.com/library/safari/documentation/AppleApplications/Reference/SafariWebContent/UsingtheViewport/

Media Queries



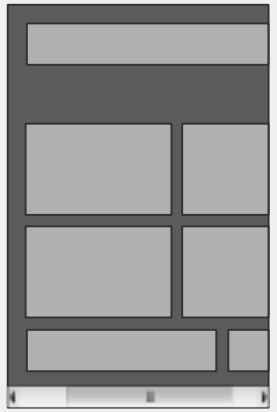
```
#header {
  height: 200px;
}
#navigation {
  width: 300px;
}
#content {
  width: 900px;
}
#footer {
  height: 200px;
}
```

```
@media screen and (max-width: 768px) {
  #header {
    width: 80px;
    height: 120px;
    display: inline;
  }
  #navigation {
    width: 560px;
    height: 120px;
  }
  #content {
    width: 640px;
    height: 760px;
  }
  #footer {
    height: 80px;
  }
}
@media screen and (max-width: 1024px) {
   ...
```

Media Queries and Fluid Layouts

Use of CSS3 media queries for defining breakpoints and style switches

```
@media screen and (max-width: 680px) { ... }
```



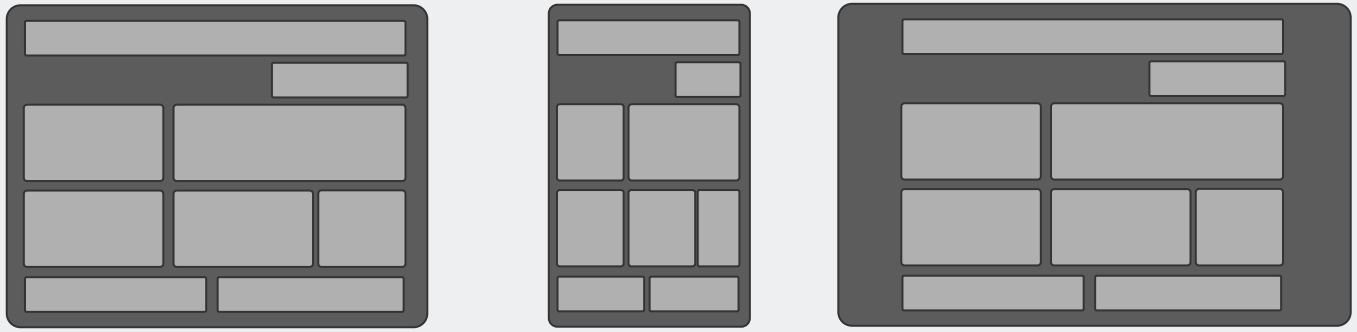
However…

- No linear progression between fix-sized designs
- Snaps at break points
- Horizontal scrolling may be required in-between
- Doesn't allow styling for future or unknown devices

Fluid Layout: Deal with the "grey area" between breakpoints

- Use relative values for sizes to resize
- Consider maximum width for content

```
#info { width: 50%; }
#container { max-width: 960px; }
```



Fluid Images

- Scale images like content using relative values
- Problems
  - Browser needs to scale
  - Large download

```
img {
  width: 50%;
  max-width: 100%;
}
```

https://html.spec.whatwg.org/multipage/embedded-content.html#adaptive-images

Responsive and Adaptive Images

- Detect visitor screen size, resolution, and pixel density
- Fetch respective image, size or version (additional download!)
- Use JavaScript, CSS media queries, and/or HTML5 markup

```
<picture>
  <source src="pic-mobile.jpg" media="(max-width: 720px)" />
  <source src="pic-tablet.jpg" media="(max-width: 1280px)" />
  <source src="pic-desktop.jpg" />
  <img src="default.png" /> <!-- User Agent not supporting picture element -->
</picture>
```

https://html.spec.whatwg.org/multipage/embedded-content.html#adaptive-images

Scaling Fonts

Scaling Fonts

- Use media queries and relative values for your fonts
- Font scales according to viewport and stays readable

```
@media screen and (min-width: 481px) and (max-width: 768px) {
  p { font-size: 0.9em; }
}
@media screen and (max-width: 480px) {
  p { font-size: 0.7em; }
}
```

What's wrong with pixels?

- Dependent on screen resolution
- Resolution increase →font size decrease
- Many modern mobile devices have high-density screens →difficult to read

CSS Layout Modes

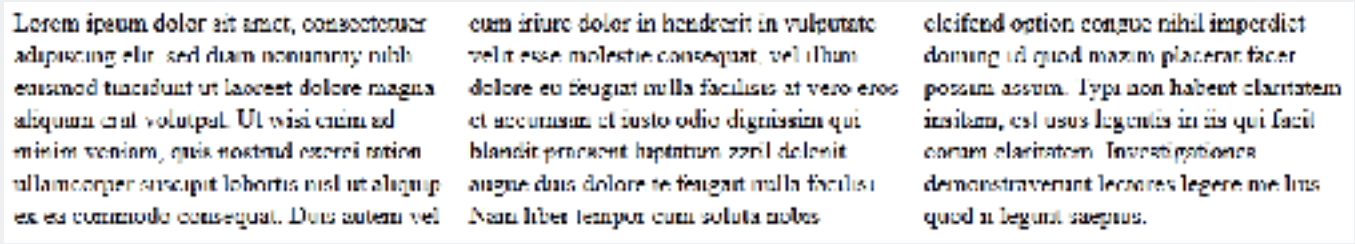
Layouts

- Block, Inline, Table, Positioned, Grid, Flexible, …
- Not all CSS properties apply to all modes
- Support for layouts still vary
  - Check with: http://caniuse.com

```
display: <mode>;
```

```
<p>Lorem ipsum dolor sit
amet, consectetuer
adipiscing elit...</p>
```

```
-webkit-column-count: 3;
-moz-column-count: 3;
column-count: 3;
```

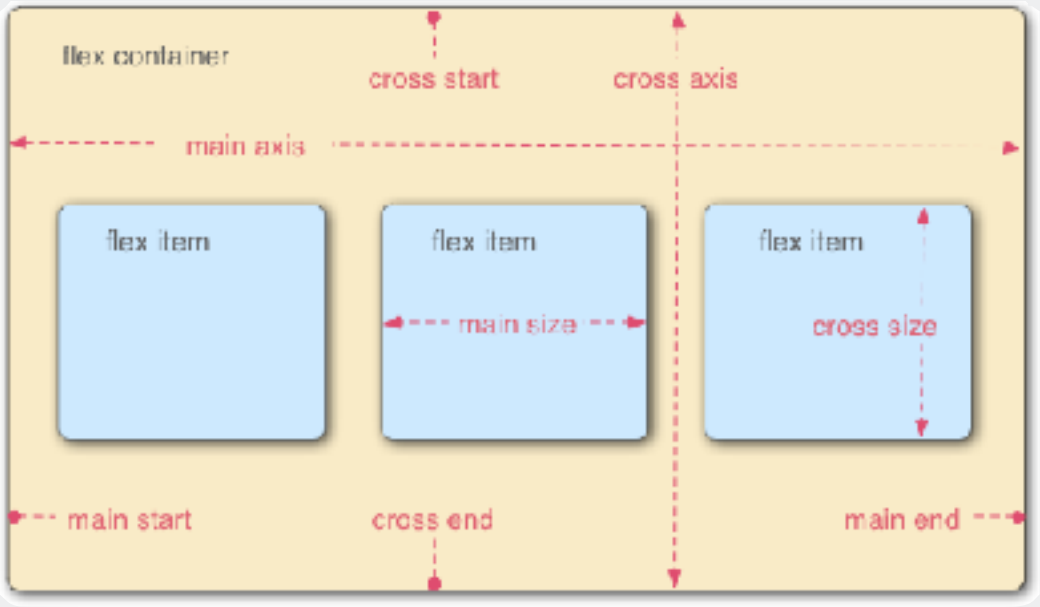


Layout Modes - Flexbox

```
display: flex;
```

Flexbox enables aligning and distributing elements within a container

- Expands items to fill available free space
- Shrinks items to prevent overflow
- Flex container: Contains flex items
- Flex items: Define properties on how the element should align and flow within the container



W3C: https://www.w3.org/TR/css3-flexbox/
Image credit: https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Flexible_Box_Layout/Using_CSS_flexible_boxes

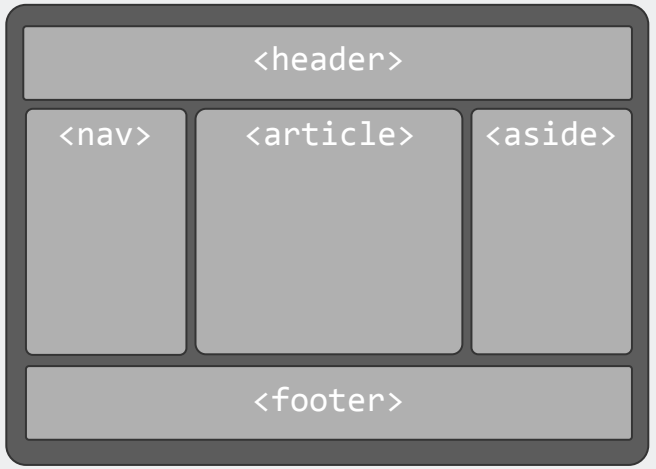
Layout Modes - Flexbox

- Container Properties
  - flex-direction, flex-wrap, flex-flow, justify-content, align-items, align-content
- Item Properties
  - order, flex-grow, flex-shrink, flex-basis, align-self

“Holy Grail Layout” with Flexbox

Holy Grail Layout

- Header, Footer
- Fluid content, fixed sides
- >2 equal height columns
- Content before remaining columns
- “order” property only for **visual** ordering



Flexible Box Layout

```
main { display: flex; }
main > article { order: 2; min-width: 12em; flex: 1; }
main > nav     { order: 1; width: 200px; }
main > aside   { order: 3; width: 200px; }

@media all and (max-width: 600px) {
  main { flex-flow: column; }
  main > article, main > nav, main > aside {
    order: 0; width: auto;
  }
}
```

```
<!DOCTYPE html>
...
<header>...</header>
<main>
  <article>...</article>
  <nav>...</nav>
  <aside>...</aside>
</main>
<footer>...</footer>
```

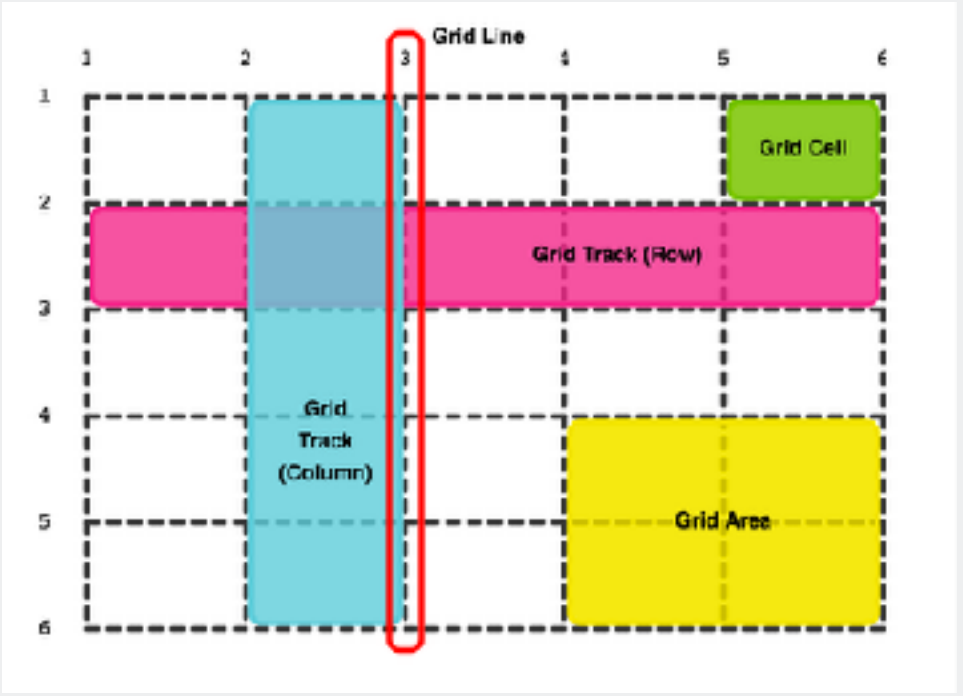
https://www.w3.org/TR/css3-flexbox/#order-accessibility

Layout Modes - Grid

```
display: grid;
```

Grid layout enables control of sizing and positioning of boxes within a grid system

- Grid Line: Horizontal and vertical dividing line within a grid
- Grid Track: Space between two adjacent grid lines — columns or rows of the grid
- Grid Cell: Single unit of the grid
- Grid Area: Adjacent grid cells that form a rectangle

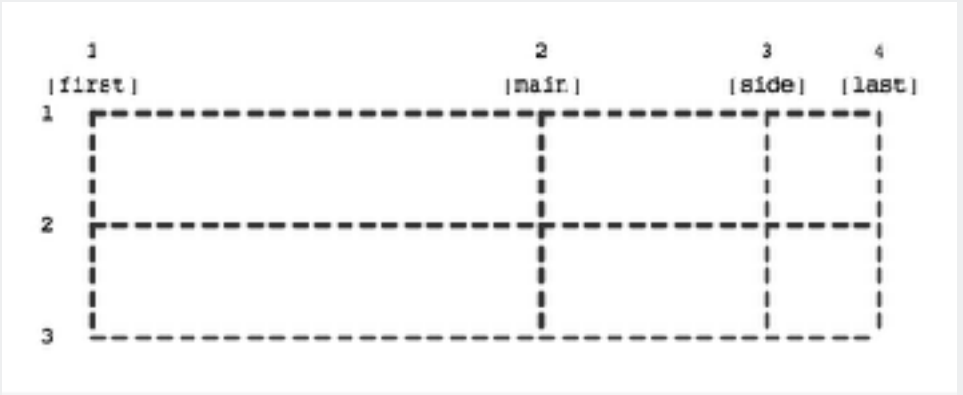


Example: Defining tracks in a grid (2 rows and 3 columns)

```
display: grid;
grid-template-rows: 100px 100px;
grid-template-columns: 400px 200px 100px;
```

Name individual lines to reference later

```
grid-template-columns: [first] 400px
[main] 200px [side] 100px [last];
```



W3C: https://drafts.csswg.org/css-grid/
Image credit: https://webkit.org/blog/7434/css-grid-layout-a-new-layout-module-for-the-web/

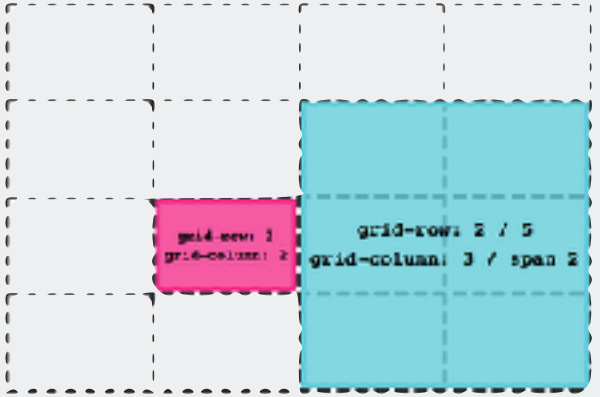
Layout Modes - Grid

Placement of child elements in the grid

- `grid-row, grid-column`
- Element in one particular grid cell
- Element spanning a grid area

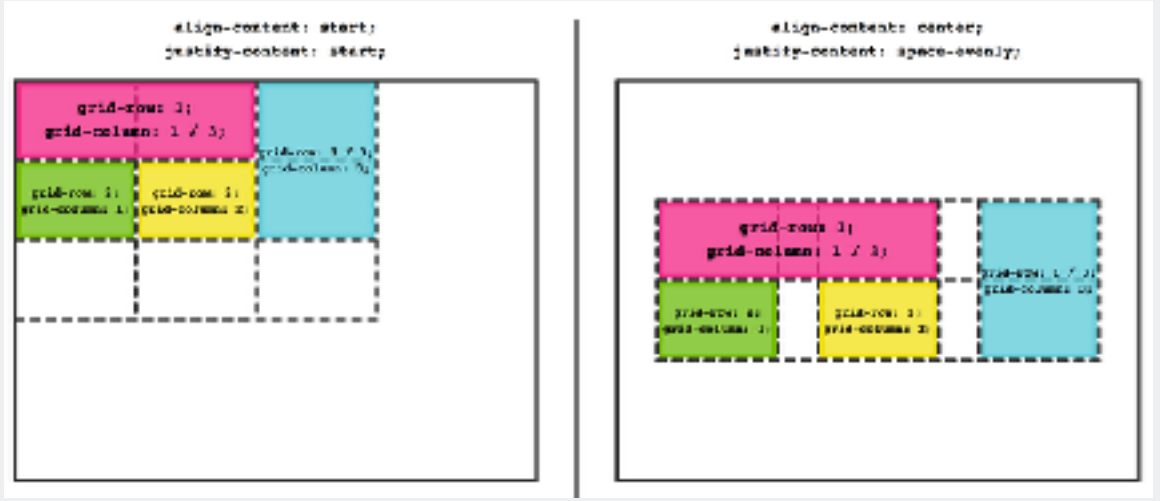
```
grid-row: 3;
```

```
grid-row: 2 / 5;
grid-column: 3 / span 2;
```



Horizontal and vertical **alignment** support

- Content distribution — align within the container
  - `justify-content` — align horizontally
  - `align-content` — align vertically
- Aligning elements within grid cell
  - `justify-self`
  - `align-self`



Layout Modes - Grid

Fractional Unit “fr”

- One part of the available space
- Can be mixed with other units when defining grid areas
- Examples of 4 column grid layout
  - All 4 columns each taking the same amount of space

```
grid-template-columns: 1fr 1fr 1fr 1fr;
```

  - 3rd column has fixed size and 4th column is relative to container size

```
grid-template-columns: 1fr 1fr 20px 20%;
```

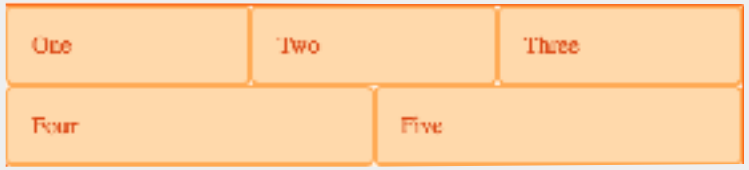
  - Multiple fractions are the sum of single fractions
    (in this example, the 4th column is the same size as column 1 and 2)

```
grid-template-columns: 1fr 1fr 20px 2fr;
```

Layout Modes - Flexbox vs Grid

One-dimensional vs Two-dimensional layout

- Flexbox (1D) - Content first
  - Enable existing content to align and adapt
  - Rules decided by children




```
.wrapper {
   width: 500px;
   display: flex;
   flex-wrap: wrap;
}

.wrapper > div {
   flex: 1 1 150px;
}
```

- Grid (2D) - Layout first
  - Specific rigid layout in mind children are placed in
  - Declaratively control specifically where elements end up — Rules decided by parent


```
.wrapper {
   display: grid;
   grid-template-columns: repeat(3, 1fr);
}
```

```
<div class="wrapper">
  <div>One</div>
  <div>Two</div>
  <div>Three</div>
  <div>Four</div>
  <div>Five</div>
</div>
```

Layout modes are not defined for entire page but for a specific container. Flexbox and Grid are not mutually exclusive within a page. Mix and match as you see fit

https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Grid_Layout/Relationship_of_Grid_Layout