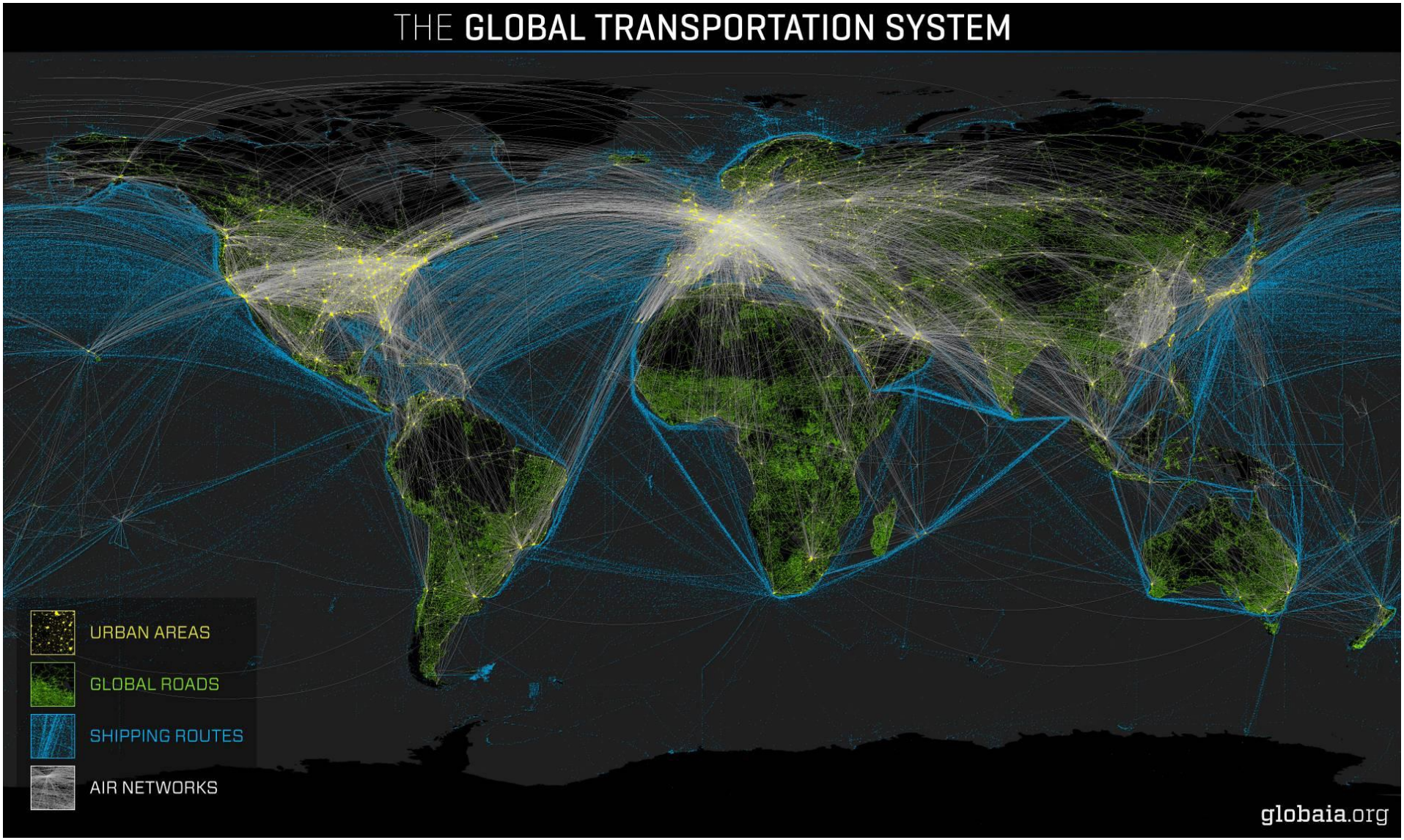
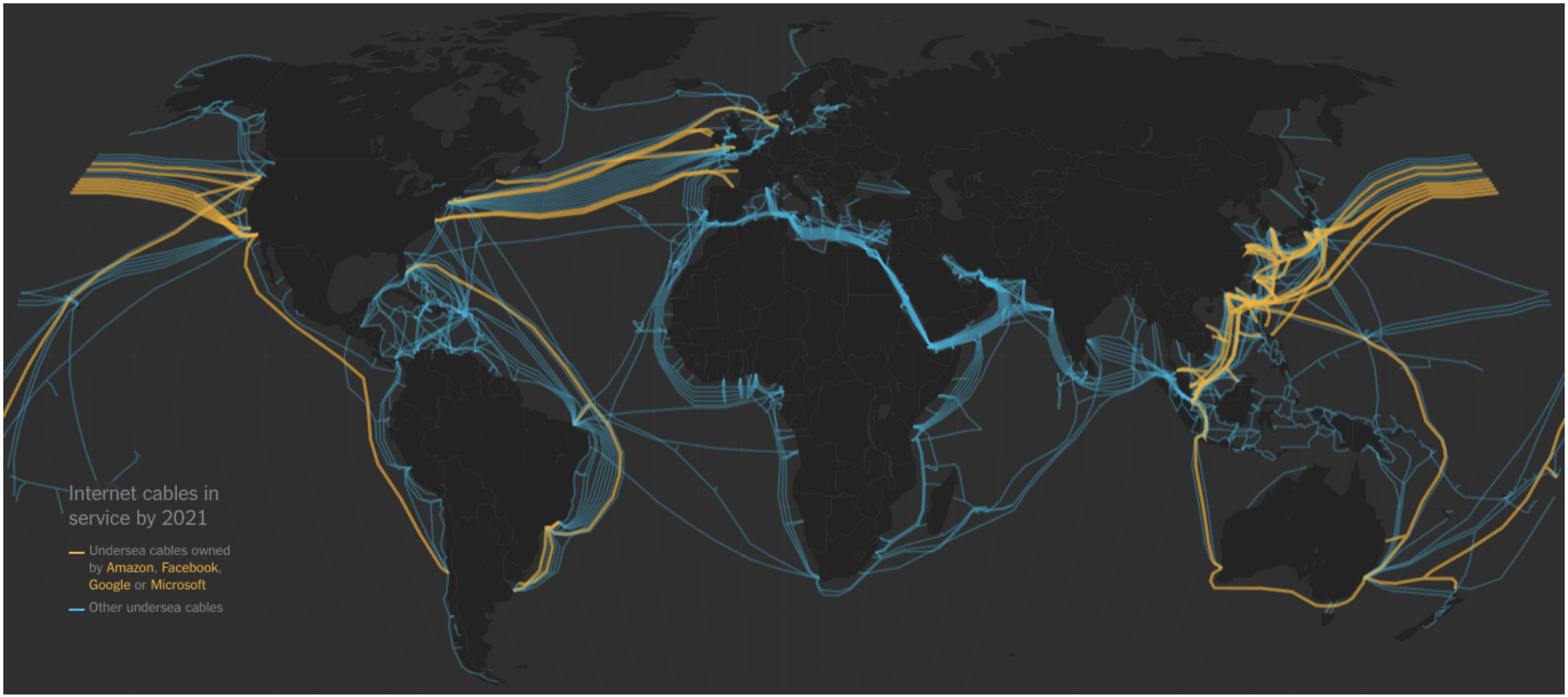
Computer practicum

5. The Internet, the World Wide Web, and HTML

Global Connectivity



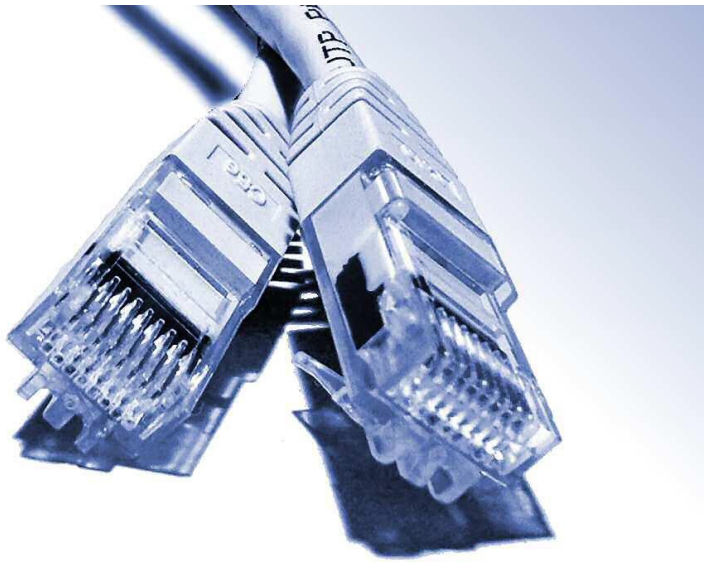
Global connectivity - intercontinental Internet (optical connections)

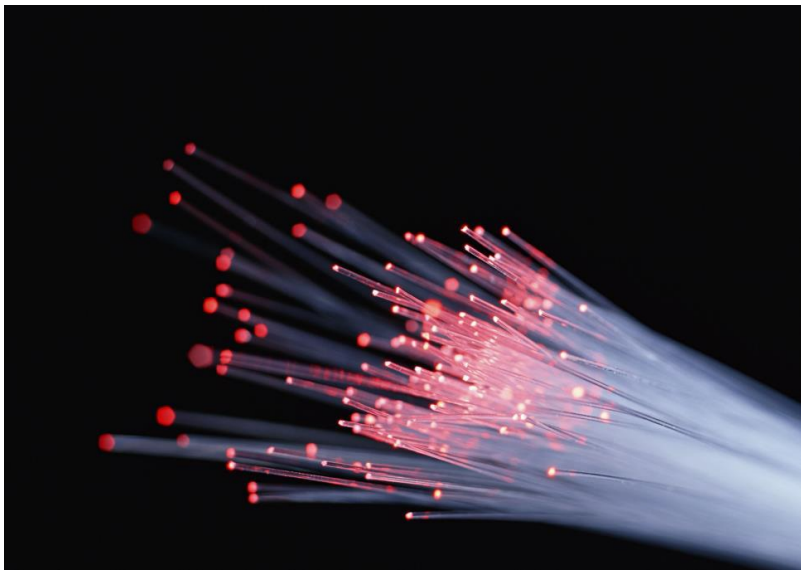


Cable connectivity

Copper cable:

- Use up to a maximum of 100m before losing signal quality
- More distance, less speed
- The most widespread standard is CAT 5e, which supports 10Mbit/s between devices up to 100m.





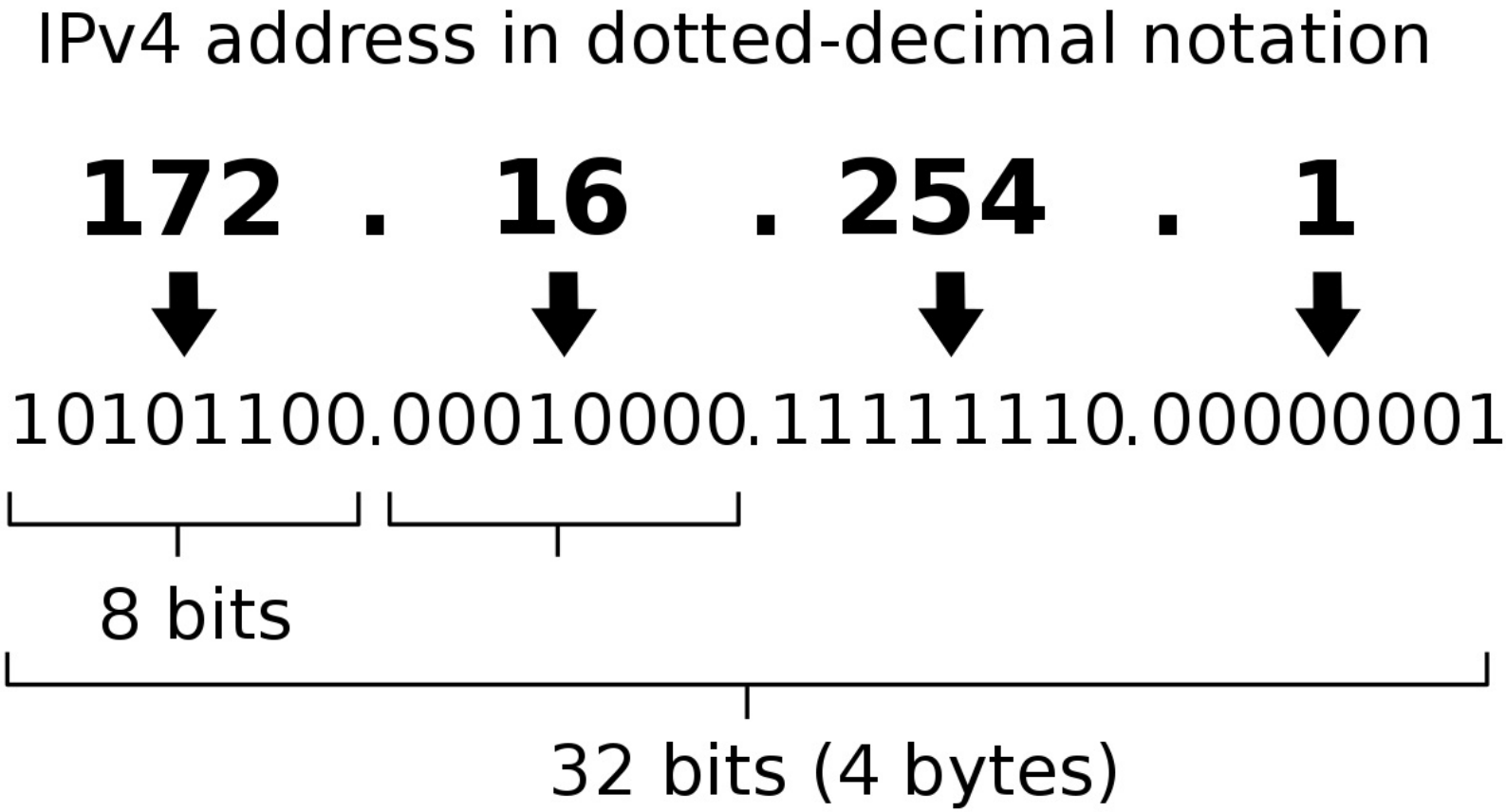
Optical cable:

- Allows for massive distances
- Enables a large download
- Very expensive solution

Internet Protocol (IP)

- The Internet is a network of devices
- Information is exchanged between devices using the Internet Protocol (IP)
- The Internet is NOT the World Wide Web - it refers to the Internet network
- Every device on the Internet has its own IP address

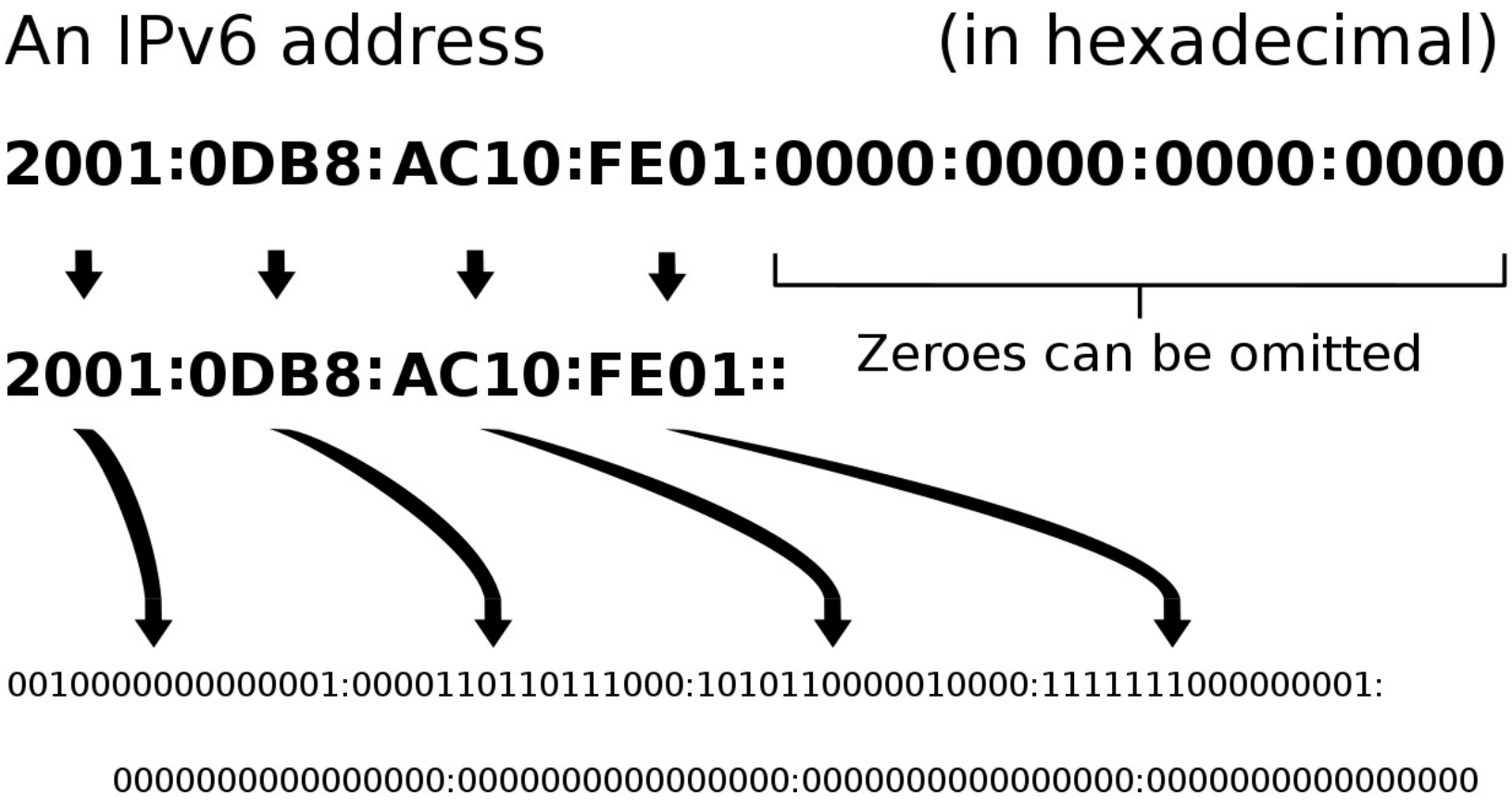
IP address (IPv4)



IP address

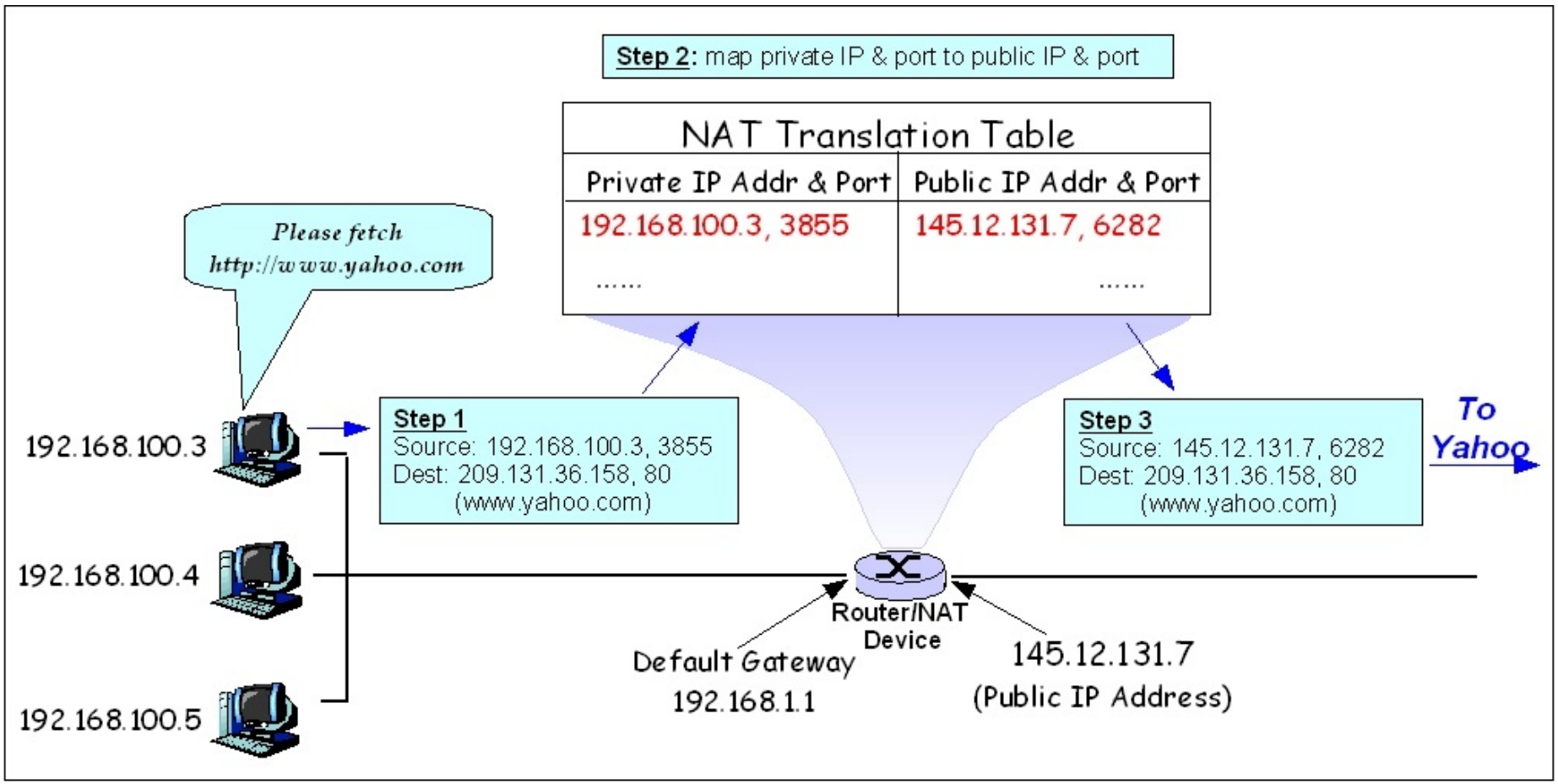
- $2^{32} = 4,294,967,292$ addresses among which $3,706,452,992$ are public
- For comparison: there are already over 8 billion people in the world
- How do we solve such a problem?
  - Multiple IP addresses: IPv6
  - Dynamic IP addresses
  - Network topology

IP address (IPv6)



Dynamic IP addresses and network topology

NAT - Network Address Translation: mapping of public IP addresses to hidden (private) ones

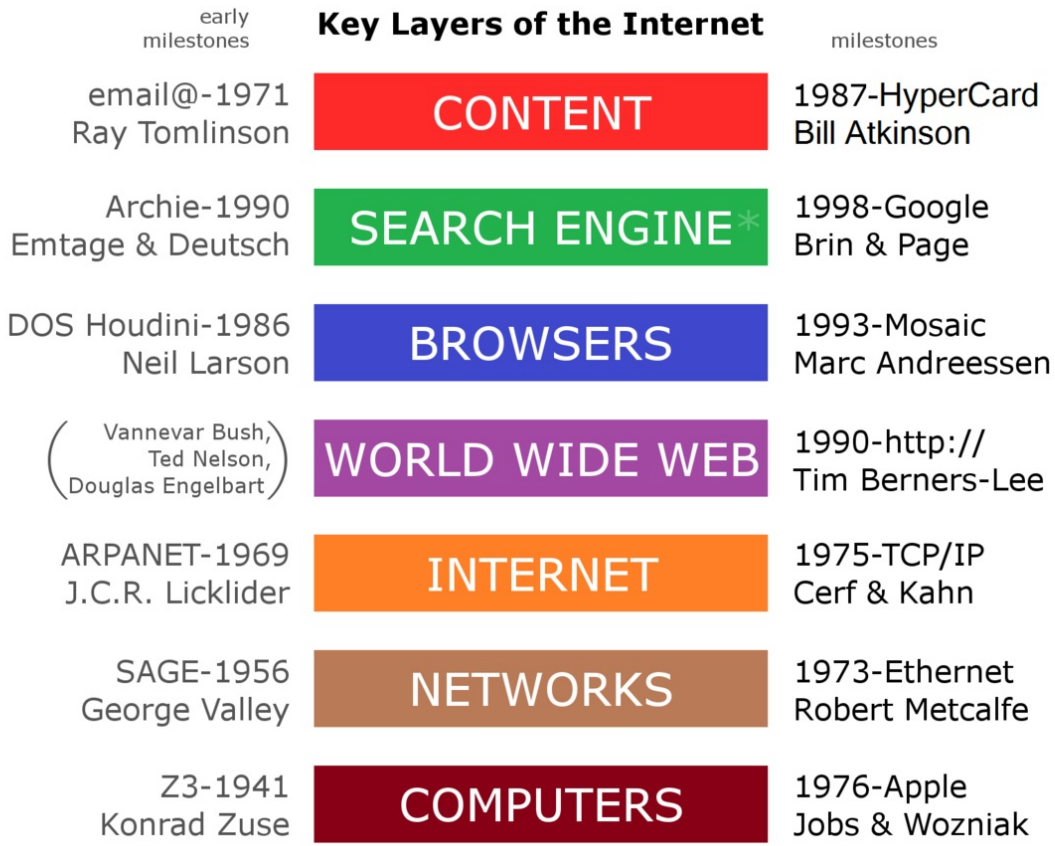


Domain

- IP address (numbers) are hard to remember
- The domain name replaces the IP address
- DNS - Domain Name Server
- You can find correspondence on various websites, example:
  - domain names to IP: https://who.is/
  - IP to domain name: https://www.nslookup.io/

World Wide Web (WWW)

- An information system where every file is marked with a URL
- URL - Uniform Resource Locator
- The files are connected to each other by hyperlinks
- The files are accessible via the Internet
- We need a web browser to access
- Files are written using HTML



HTML: HyperText Markup Language

HTML - HyperText Markup Language

- It is the most basic component of the World Wide Web
- It is a simple markup language
- Most markup languages are human readable
- It is used to create web pages
- Along with HTML we also use:
  - CSS - layout / presentation of the website
  - JavaScript (JS) - website functionality / behavior

HTML - HyperText Markup Language

- Markup language for creating web pages
- Hypertext defines a link between web pages
- HTML is used to mark up text so that a machine can understand and manipulate it accordingly
- Uses tags to specify what to do with the text and defines the structure of the web page
- NOT a programming language, as we only manage the presentation of information on the web with it, we do not use it for logic programming
- **CTRL + u** or right click on the page and "View Page Source"displays the HTML document of the web page in the browser.
- **CTRL + Shift + i** for more tools to inspect page properties (including source)

Advantages of the HTML language

- easy to use
- free, all you need is a text editor and a browser
- is supported by all browsers
- easy integration with other languages: JavaScript, Ruby, PHP, Perl and many others

Disadvantages of HTML

- lacks security
- we need a lot of tags for the base page
- only static web pages (dynamics is achieved, for example, with JavaScript)
- is not centralized - we have to design all related web pages separately or use CSS
- extremely complex to build a large website

HTML Page Structure

- HTML consists of various elements that tell the browser how to display content.
- By convention, we use lowercase letters without spaces for element names

```
<!DOCTYPE html>
<html>

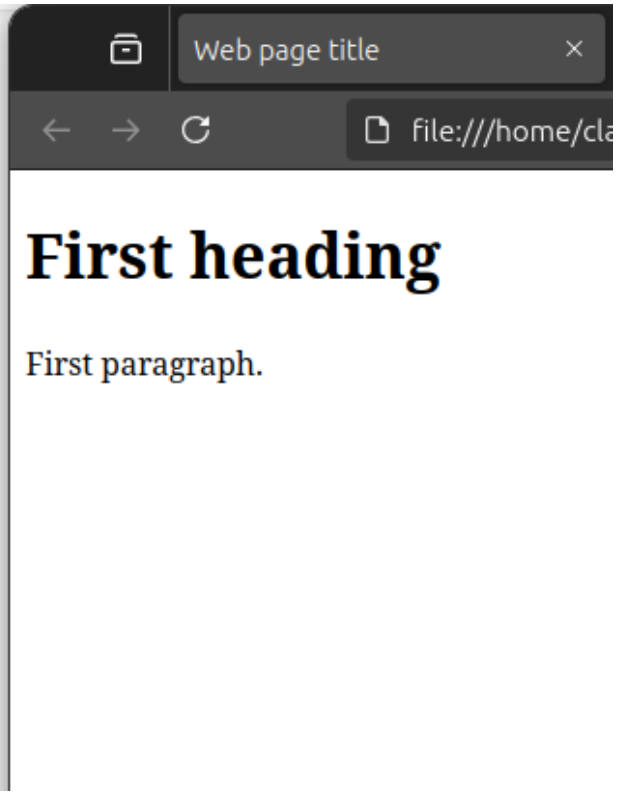
  <head>
    <title>Web page title</title>
  </head>

  <body>

    <h1>First heading</h1>
    <p>First paragraph.</p>

  </body>

</html>
```



HTML Page Structure

- <!DOCTYPE html> is a document type declaration. Every html document must start with a document type declaration.
- Each HTML document then starts with the <html> tag and ends with the </html> tag.
- The HTML document is then divided into two parts:
- **head** - contains all information about the HTML document (title, metadata, style, scripts, ...).
- **body** - defines all visible elements of the web page (titles, text paragraphs, images, hyperlinks, tables, ...).

HTML head

- The HTML head mainly contains **metadata** about the web page
- Can contain the page title, scripts, styles, and other meta information used by content crawlers
  - **Title**: This is displayed as the name of the webpage in the title bar of the browser (displayed of the tab)
  - **Scripts**: e.g. JavaScript scripts are often included in the header of an HTML file
  - **Styles**: Internal and external style rules (eg CSS styles) are also included in the header of the HTML file
  - **Meta**: some meta data such as *description* or *keywords*, useful for content search engine, can be included in the header of the HTML file.
- The data in the header of the HTML file are not visible in the main browser window.

Example HTML head

Example of HTML Head Element data

Markup Copy

```
<!DOCTYPE html>
<html>

<head>
<title> HTML Head Tutorial - TutorialsClass.com </title>
<meta charset="UTF-8">
<meta name="description" content="This website provides free online tutorials">
<meta name="keywords" content="HTML, CSS, PHP, SEO">
<meta name="author" content="TutorialsClass.com">
<link rel="stylesheet" type="text/css" href="style.css">
<script type="text/javascript">
alert("Simple JavaScript Alert");
</script>
</head>

<body>
This is sample content.
</body>

</html>
```

HTML elements

- an HTML element is everything inside the **start and end tags**
  <Tagname>Element content...</Tagname>
- Most tags appear like this in pairs. A few elements only have an initial mark: those are the **empty elements**.
- We also differentiate **block elements** and **inline elements**.
- tags can contain **attributes**, that gives additional information on the tag/element as <Tagname attribute="value">...
- A special element: **comments** that do not appear on the website are given as:
  <!-- Here is the comment -->

HTML elements

Block elements:

- In general delimitate a block of text for the structure of the page.
- They always start on a new line.
- They occupy the entire width of the available space.
- Some basics: , <p>, <pre> <hr>, <table>, <li>, ...

Inline elements:

- We use them inside blocks in a line (they don't require a new line).
- They only take up as much space as they need.
- Some basics: <a>, <br>, text editing elements, ...

Empty elements:

- no content and no closing tags.
- There are a fewer of them, most common: <br> for new line (line **br**eak); <hr> for **h**orizontal line; <img> for inserting an **im**a**g**e, and <link> with which we will add CSS formatting.

More elements: https://www.w3schools.com/html/html_blocks.asp.

HTML heading (=title of section)

- The web page **h**eadings are written in the elements <h1> to <h6>. They indicate six levels of heading where **h1** is the most important heading.
- *Block elements (content and closing tag).*

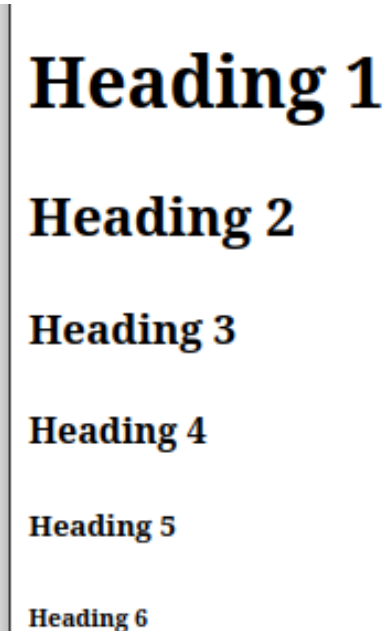
```
<!DOCTYPE html>
<html>

  <body>

    <h1>Heading 1</h1>
    <h2>Heading 2</h2>
    <h3>Heading 3</h3>
    <h4>Heading 4</h4>
    <h5>Heading 5</h5>
    <h6>Heading 6</h6>

  </body>

</html>
```



HTML text paragraphs

- The elements <p> indicate **p**aragraphs, or the basic text on the website.
- *Block elements (content and closing tag).*
- They always start on a new line. Browsers automatically add some space before and after a paragraph.
- Adding extra spaces or lines does not change the appearance of the page because browsers remove them automatically.

```
<!DOCTYPE html>
<html>
  <body>
    <p>
    This paragraph
    contains         a lot of spaces
    in the source          code,
    but the        browser
    ignores it.
    </p>
  </body>
</html>
```

This paragraph contains a lot of spaces in the source code, but the browser ignores it.

HTML text paragraphs

- The elements <p> indicate **p**aragraphs, or the basic text on the website.
- *Block elements (content and closing tag).*
- They always start on a new line. Browsers automatically add some space before and after a paragraph.
- Adding extra spaces or lines does not change the appearance of the page because browsers remove them automatically.
- The element <pre> for **pre**formatted paragraph is very similar to <p>, but indicates the text is already formatted text. As a result, it preserves both spaces and newlines.

```
<!DOCTYPE html>
<html>
  <body>
    <pre>
    This paragraph
    contains         a lot of spaces
    in the source          code,
    but the        browser
    ignores it.
    </pre>
  </body>
</html>
```

```
This paragraph
contains         a lot of spaces
in the source          code,
but the        browser
ignores it.
```

HTML text formatting

Those are *inline elements (content and closing tag)*.

- <b> - **b**old text
- - text with **strong** importance
- <i> - **i**talic text
- - **em**phasized (=important) text
- <mark> - **mark**ed (highlighted) text
- <small> - **small** text
- <strike> - **strike** (=cross out) text
- <del> - **del**eted text
- <u> - **u**nderlined text
- <ins> - **ins**erted text
- <sub> - **sub**script (=index) text
- <sup> - **sup**erscript (=exponent) text

HTML text formatting

```
<!DOCTYPE html>
<html>
  <body>
    <b>Bold</b>
    <strong>Strong</strong>
    <i>Italic</i>
    <em>Emphasize</em>
    <mark>Mark</mark>
    <small>Small</small>
    <strike>Strike</strike>
    <del>Deleted</del>
    <u>Underline</u>
    <ins>Inserted</ins>
    <sub>Subscript</sub>
    <sup>Superscript</sup>
  </body>
</html>
```

Bold **Strong** *Italic*
Emphasize Mark Small
~~Strike~~ ~~Deleted~~
Underline Inserted
Subscript Superscript

Note that even if some have similar visual, they do not have same meaning: using ‘strong’ means that you want the text to be bold because it is important, using ‘bold’ does not have this meaning.

HTML attributes

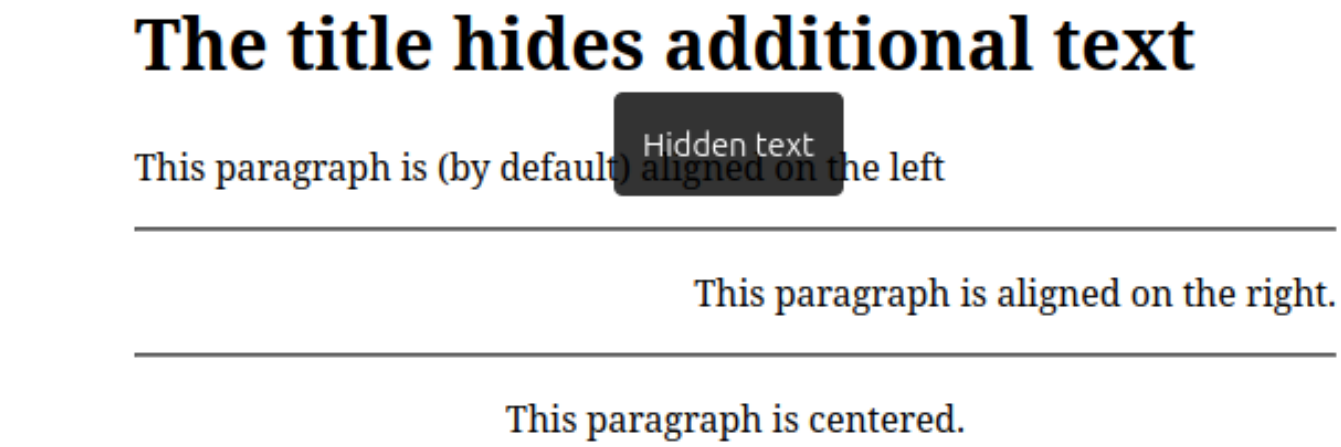
- HTML elements can have **attributes** (=properties) that define additional information and styles for individual elements.
- Attributes are composed in pairs: name="value"
- Other examples:
  - lang: Add it to the <html> element to specify the language. It is always wise to determine it. (en, en-US, sl,...)
  - title: defines what is displayed if the mouse is placed on the element. It is available to most elements.
  - align: allows editing the left, right and center alignment of the text.

HTML attributes

```html
<!DOCTYPE html>
<html lang="en">
  <body>

    <h1 title="Hidden text">The title hides additional text</h1>
    <p>This paragraph is (by default) aligned on the left</p>
    <hr>
    <p align="right">This paragraph is aligned on the right.</p>
    <hr>
    <p align="center">This paragraph is centered.</p>

  </body>
</html>
```



HTML attribute - style

- The attribute style allows adding styles to elements, e.g.: color, font, size, ...
- This attribute is basically a direct CSS styling of an individual element (more on CSS next time).
- Some formatting examples (add a semicolon to separates individual formatting):
  - Text color: style="color:red;"
  - Background color: style="background-color:powderblue;"
  - Font style: style="font-family:verdana;"
  - Font size: style="font-size:16pt;"
  - Alignment: style="text-align:center;"
- More about colors *here*.

HTML attributes - style

```
<!DOCTYPE html>
<html lang="en">
  <body>

  <h1>Editing with the style attribute</h1>

  <pre style="color:red; background-color:powderblue;">
  Let's change the color and background.
  </pre>

  <pre style="font-family:courier; font-size:16pt; text-align:center;">
  Let's change the font, size and alignment.
  </pre>

  </body>
</html>
```

Editing with the style attribute

Let's change the color and background.

Let's change the font, size and alignment.

HTML lists

All elements described below are *block elements (content and closing tag)*.

- We can do **ordered (=numbered)** and **unordered (=bulleted) lists**.
- Use the tag <ul> for an **u**nordered **l**ist, and the tag <ol> for an **o**rdered **l**ist.

HTML lists

All elements described below are *block elements (content and closing tag)*.

- We can do **ordered (=numbered)** and **unordered (=bulleted) lists**.
- Use the tag <ul> for an **u**nordered **l**ist, and the tag <ol> for an **o**rdered **l**ist.
- The elements of the list are listed with the tag <li> (**l**ist **i**tem).
- Labels for items in an unordered list: disc (default), circle, square, none.
  Usage example: <ul style="list-style-type:disc">
- Labels for elements in an ordered list: 1 (default), A, a, I, i to choose numeric, alphanumeric or Roman numerals.
  Usage example: <ol type="A">

HTML unordered and ordered list

```
<!DOCTYPE html>
<html>
  <body>

    <p>Default is disc.</p>
    <ul style="list-style-type:disc">
      <li>Red</li>
      <li>Green</li>
      <li>Blue</li>
    </ul>

    <ul style="list-style-type:circle">
      <li>Red</li>
      <li>Green</li>
      <li>Blue</li>
    </ul>

    <ul style="list-style-type:square">
      <li>Red</li>
      <li>Green</li>
      <li>Blue</li>
    </ul>

    <ul style="list-style-type:none">
      <li>Red</li>
      <li>Green</li>
      <li>Blue</li>
    </ul>

  </body>
</html>
```

Default is disc.

- Red
- Green
- Blue

- Red
- Green
- Blue

- Red
- Green
- Blue

Red
Green
Blue

```
<!DOCTYPE html>
<html>
  <body>
    <p>Default is 1.</p>
    <ol type="1">
      <li>Red</li>
      <li>Green</li>
    </ol>

    <ol type="A">
      <li>Red</li>
      <li>Green</li>
    </ol>

    <ol type="a">
      <li>Red</li>
      <li>Green</li>
    </ol>

    <ol type="I">
      <li>Red</li>
      <li>Green</li>
    </ol>

    <ol type="i">
      <li>Red</li>
      <li>Green</li>
    </ol>
  </body>
</html>
```

Default is 1.

1. Red
2. Green

A. Red
B. Green

a. Red
b. Green

I. Red
II. Green

i. Red
ii. Green

HTML hyperlinks

- Element that provide a link to another page within the website or to an external website.
- Can be placed on texts, images, buttons and others.
- Hyperlinks are created inside (**a**nchor) tag <a>.
- *Inline elements (content and closing tag) with attribute.*
- We write the link with the attribute href.
- clickable text

More at: https://www.w3schools.com/html/html_links.asp

```
<!DOCTYPE html>
<html>
  <body>
    <a href="https://www.famnit.upr.si/sl/">This is a hyperlink</a>
  </body>
</html>
```

HTML images

- The element <img> is used to insert an **image**.
- *empty elements with attribute.*
- We need to specify the location (path) of the image in our file system under the attribute src.
- It is always wise to add the size of the image with the attributes width and heigth (in pixels) or style. For CSS editing, it is better to use styles, but it depends on the case.
- Examples:
  <img src="picture.jpg" width="128" height="128">
  <img src="Image.jpg" style="width:128px;height:128px;">

More at: https://www.w3schools.com/html/html_images.asp

HTML images

```
<!DOCTYPE html>
<html>

  <body>

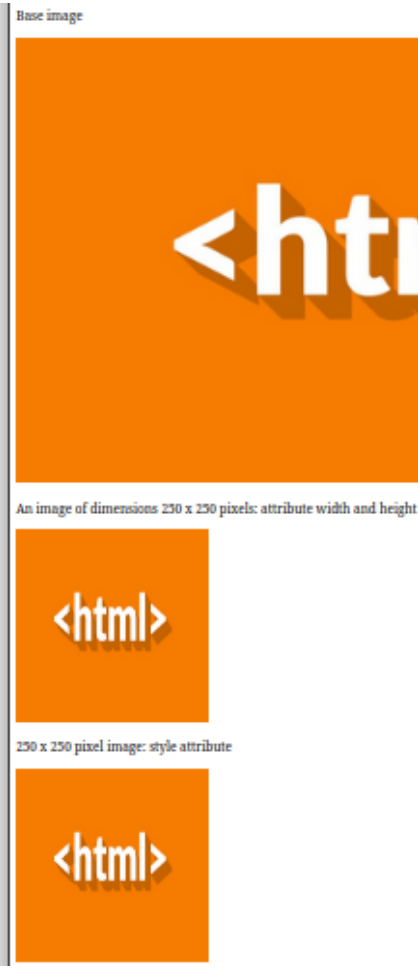
    <p>Base image</p>
    <img src="HTML-Image.jpg">

    <p>An image of dimensions 250 x 250 pixels: attribute width and height</p>
    <img src="HTML-Image.jpg" width="250" height="250">

    <p>250 x 250 pixel image: style attribute</p>
    <img src="HTML-Image.jpg" style="width:250px;height:250px;">

  </body>

</html>
```



HTML images - figure element

- Images can be inserted independently or within the <figure> element.
- *Block elements (content and closing tag).*
- It gives us more control over editing the image and its layout.
- We can also add a description of the image inside this element using the <figcaption> element, which is also a *block elements*.

```
<!DOCTYPE html>
<html>
  <body>

    <figure>
      <img src="HTML-Image.jpg" width="250" height="250">
      <figcaption>This is the description of the image</figcaption>
    </figure>

  </body>
</html>
```



This is the description of the image

HTML tables

All elements described below are *block elements (content and closing tag)*.

- A **table** is created with the <table> element.
- Tables are written in rows. Each row is specified inside a <tr> (**t**able **r**ow) element.
- Entries are given inside <td> (**t**able **d**ata) elements.
- Highlighted entries (usually first line, first column) can be given inside <th> (**t**able **h**eading) elements.

HTML tables - additional editing

- By default, <th> elements are centered, and <td> elements are aligned on the left. To make an entry centered, we can add the *empty element* .
- The rowspan attribute of the <th> and <td> elements determines how many rows a given entry spans. When writing the next lines over which it extends, we skip those elements.
- The colspan attribute of the <th> and <td> elements determines how many columns a given entry spans.
- The border attribute of the <table> element shows us the borders of the table of the specified thickness in pixels.

HTML tables - examples

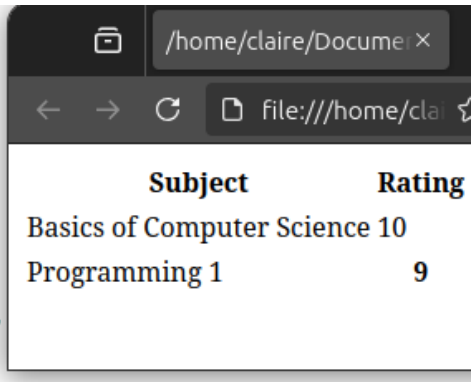
```html
<!DOCTYPE html>
<html>

  <body>

  <table>
    <tr>
      <th>Subject</th>
      <th>Rating</th>
    </tr>
    <tr>
      <td>Basics of Computer Science</td>
      <td>10</td>
    </tr>
    <tr>
      <td>Programming 1</td>
      <th>9</th>
    </tr>
  </table>

  </body>

</html>
```




```html
<!DOCTYPE html>
<html>
  <body>

    <table border="1">
      <tr>
        <th rowspan=2>Subject</th>
        <th colspan=2>Score</th>
      </tr>
      <tr>
        <th>Numerical</th>
        <th>With the word</th>
      </tr>
      <tr>
        <td>Basics of Computer Science</td>
        <td><center>10</td>
        <td>Great</td>
      </tr>
      <tr>
        <td>Programming 1</td>
        <td><center>9</td>
        <td>Very well</td>
      </tr>
    </table>

  </body>
</html>
```

Subject	Score	
	Numerical	With the word
Basics of Computer Science	10	Great
Programming 1	9	Very well

More about the HTML language at

- *https://tutorialsclass.com/learn/html/*
- *https://www.w3schools.com/html/default.asp*
- *https://www.geeksforgeeks.org/html-introduction/?ref=lbp*