Browsers: Behind the scenes

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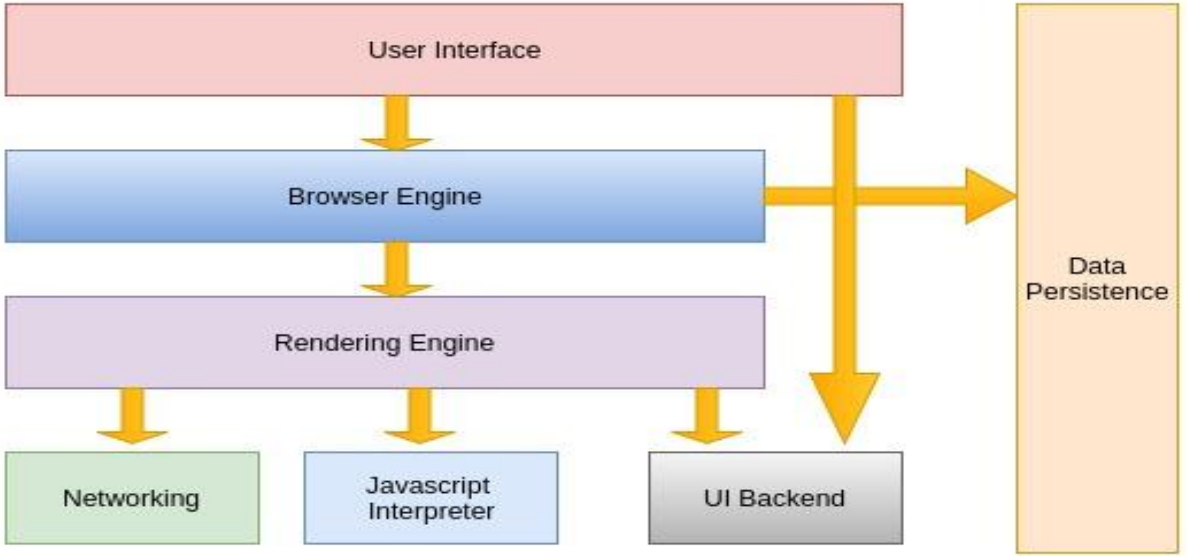
I am ..

- Software UI Engineer.
- Alumni of Outreachy and RGSoC internship program.
- Associated with RGSoC as volunteer.
- Co-organizer of @Diversify meetup group.

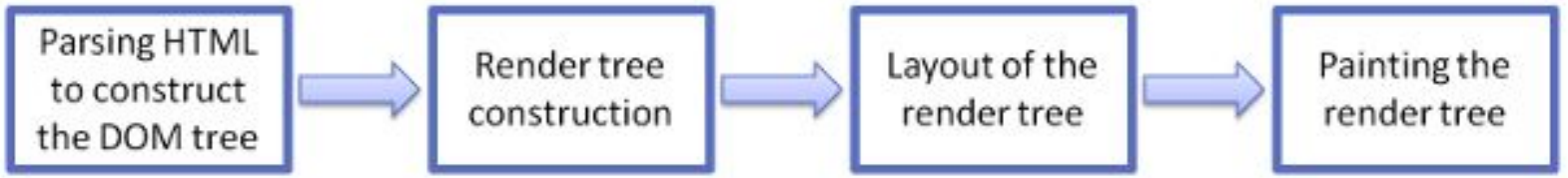
High Level Architecture of Browser



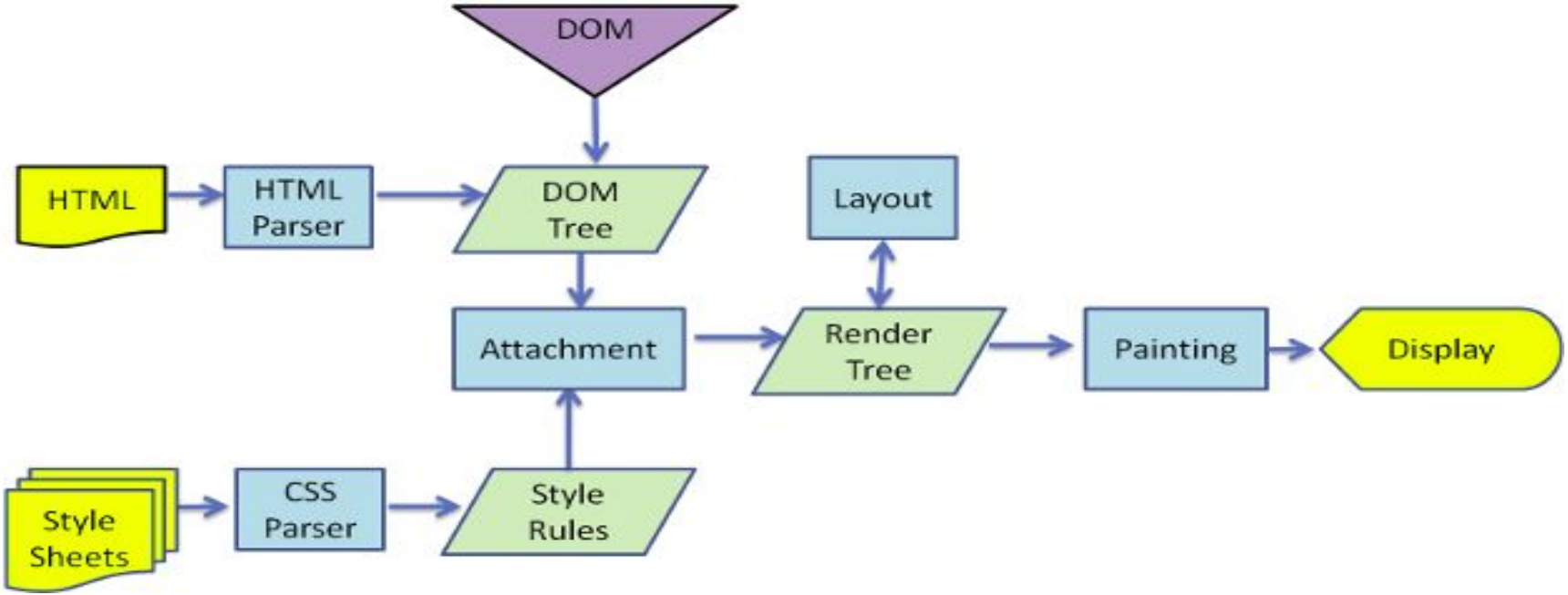
I will be mostly talking about Rendering engine!

Rendering Engine

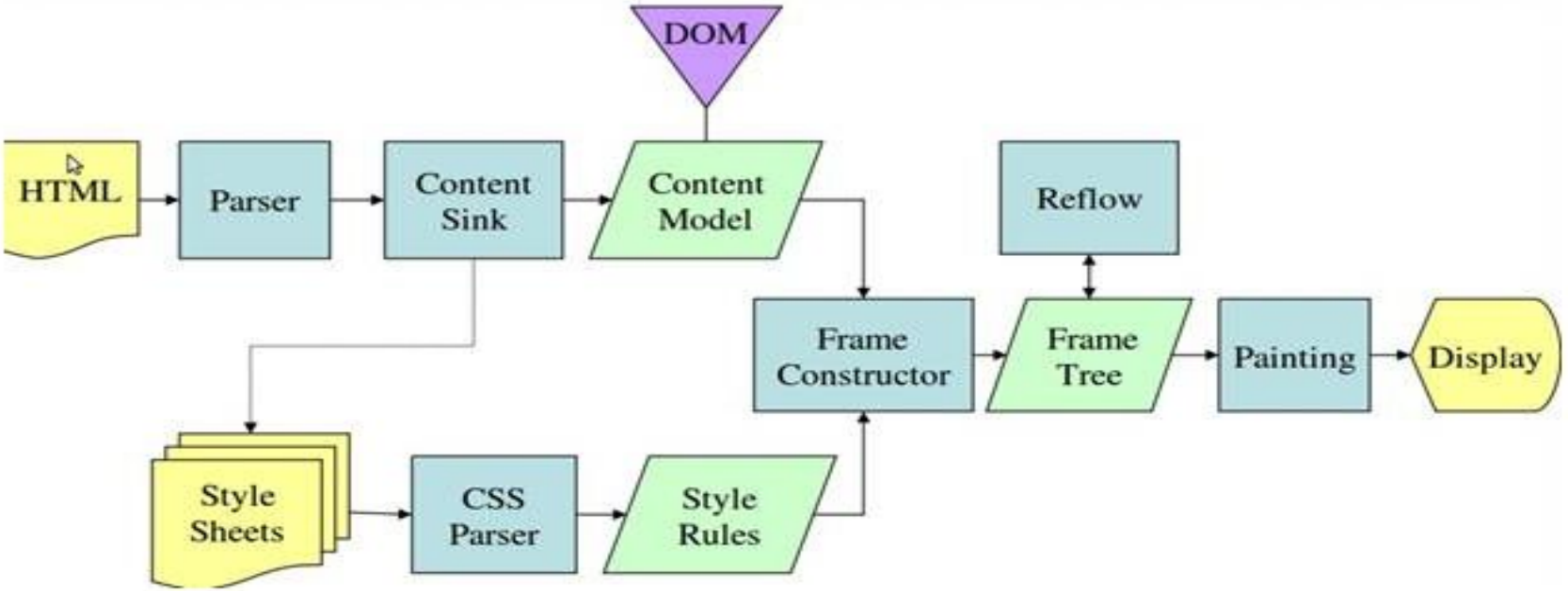
- The responsibility of the rendering engine is well... Rendering, that is display of the requested contents on the browser screen.



WebKit Workflow



Gecko Rendering Engine Workflow



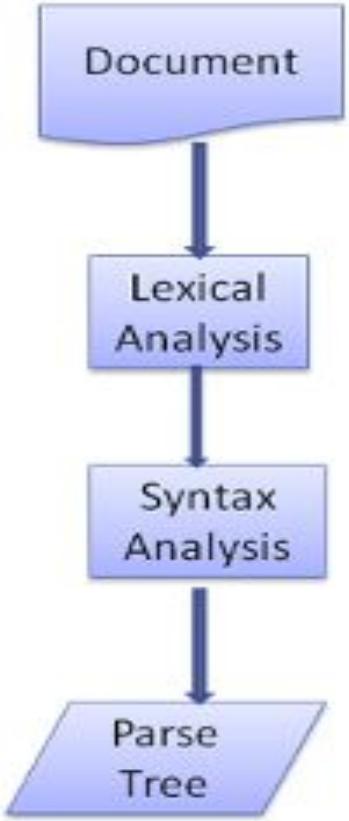
What is parsing?

- Parsing is translating a document into some structure that **Make Sense.**
- Parsing is based on the syntax rules the document obeys
- Result is usually a tree of nodes.
- Also called as a syntax tree.

Context free Grammars

Every format that you can parse must have deterministic grammar consists of vocabulary and syntax rules.

That is called Context Free Grammars!


Document
Lexical Analysis
Syntax Analysis
Parse Tree

Lexical Analysis

Lexical analysis is the process of breaking the input into tokens

Tokens are the collection of valid building blocks

Syntax Analysis

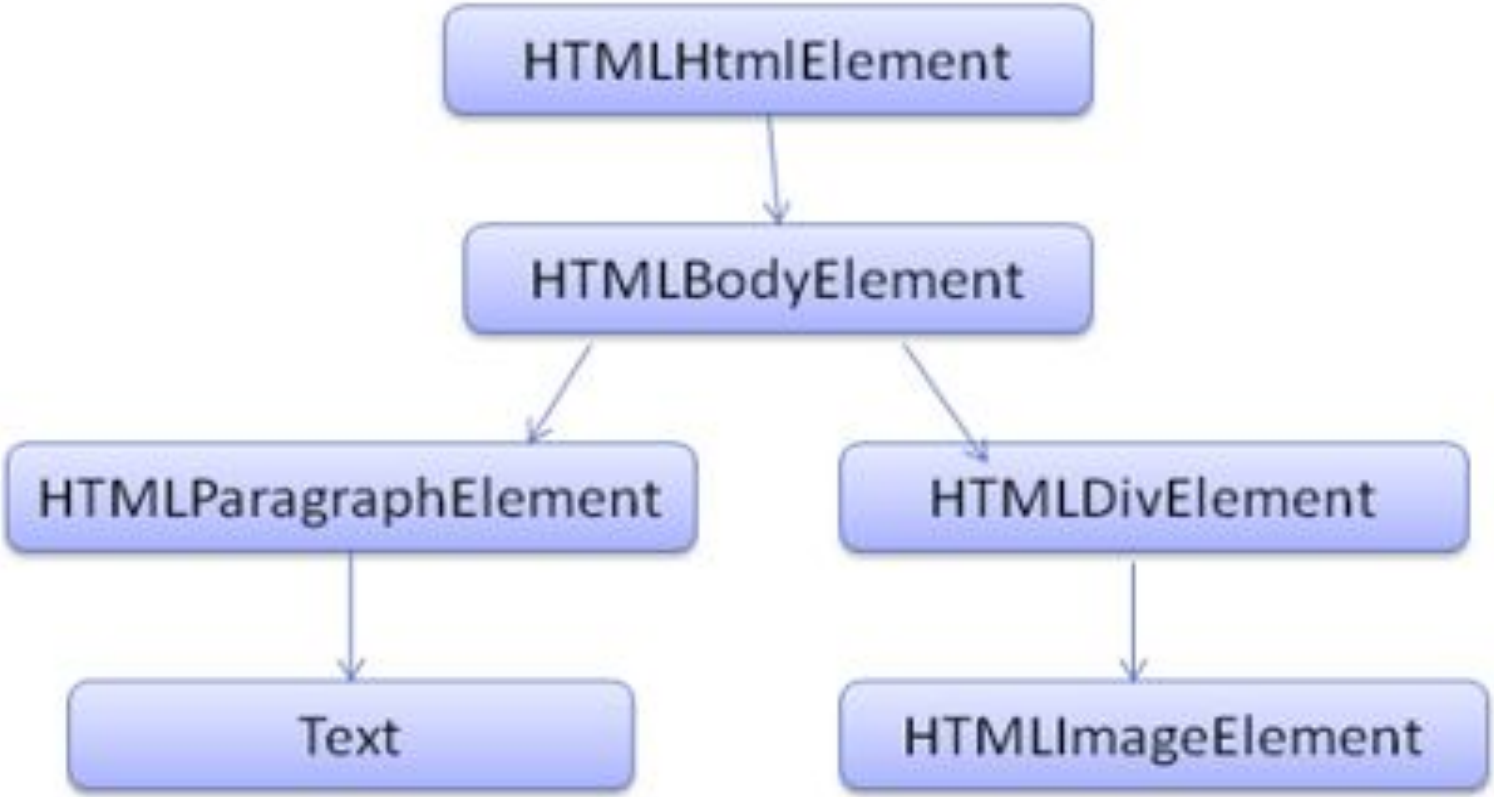
- Syntax analysis is the applying of the language syntax rules.
- The parsing process is iterative.
- The parser will usually ask the lexer for a new token and try to match the token with one of the syntax rules.

HTML parser

- Job of the HTML parser is to parse the HTML markup into a parse tree.
- Formal format for defining HTML - DTD (Document Type Definition)
- The HTML DTD doesn't form a context free grammar.

DOM TREE

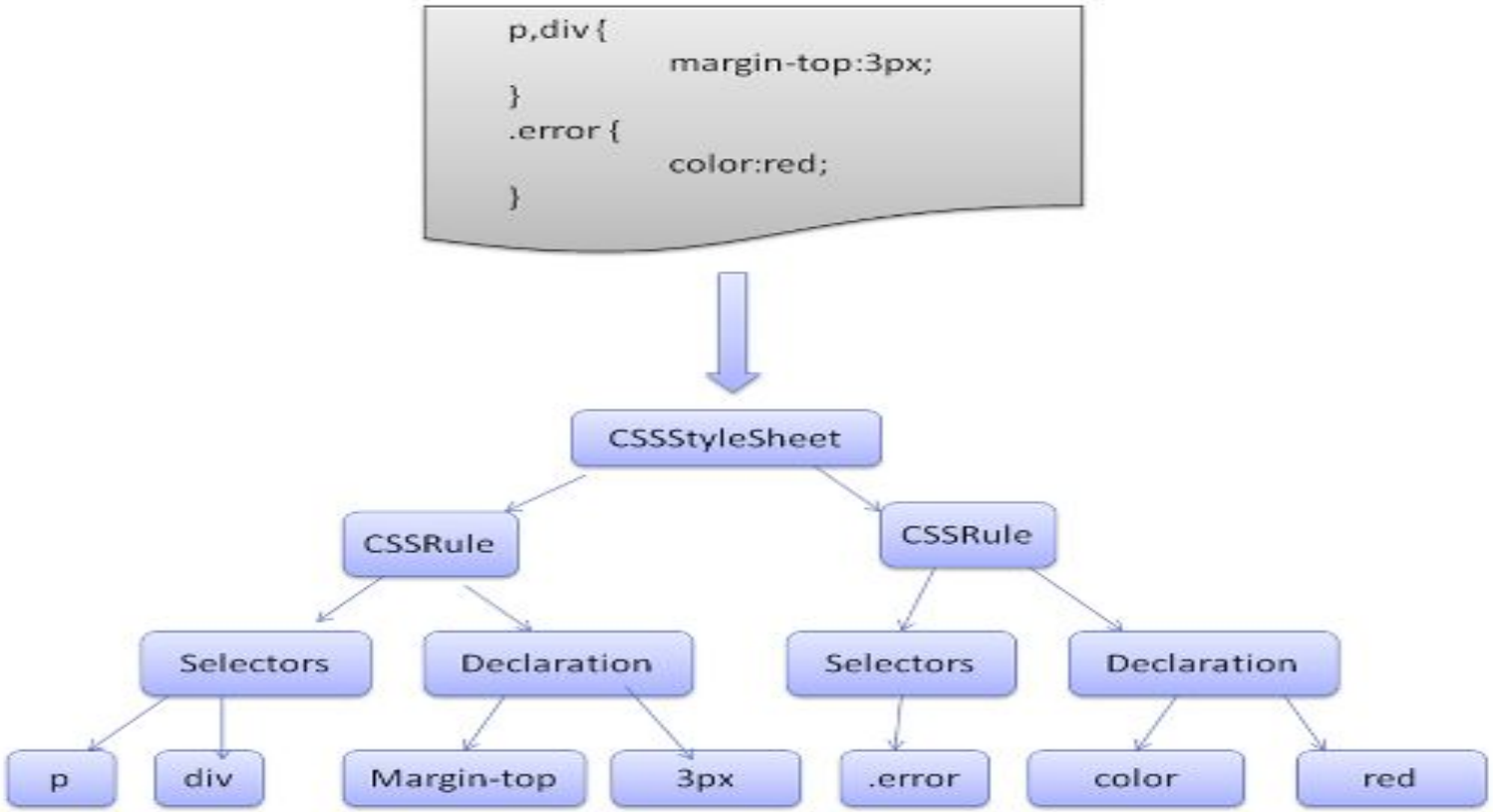
```
<html>
    <body>
        <p>
            Hello World
        </p>
        <div> <img src="example.png"/></div>
    </body>
</html>
```


HTMLHtmlElement
HTMLBodyElement
HTMLParagraphElement
HTMLDivElement
Text
HTMLImageElement

CSS Parsing

Unlike HTML, CSS is a context free grammar and can be parsed using the types of parsers.

CSS specification defines CSS lexical and syntax grammar


p,div{
margin-top:3px;
}
.error{
color:red;
}
CSSStyleSheet
CSSRule
CSSRule
Selectors
Declaration
Selectors
Declaration
p
div
Margin-top
3px
.error
color
red

Render Tree Construction

While the DOM tree is being constructed, the browser constructs another tree, the render tree.

Firefox calls the elements in the render tree "frames".

Webkit uses the term renderer or render object

Layout & Painting

- When the renderer is created and added to the tree, it does not have a position and size. Calculating these values is called layout or reflow.
- Painting is displaying the content on the screen.

Browser Error Tolerance

```
<html>
    <mytag>
    </mytag>
    <div>
    <p>
    </div>
        Hello
    </p>
</html>
```

WebKit Error tolerance

- A stray table! It is a table inside another table contents but not inside a table cell.

```
<table>
        <table>
                <tr><td>inner table</td></tr>
         </table>
                <tr><td>outer table</td></tr>
</table>
```

Webkit will change the hierarchy to two sibling tables:

```
<table>
      <tr><td>outer table</td></tr>
</table>
<table>
      <tr><td>inner table</td></tr>
 </table>
```

People who are wondering why firefox quantum is fast?

Because we have a super fast CSS engine inside it.
i.e Quantum CSS (aka Stylo)

Questions?

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