

# P. PORTO

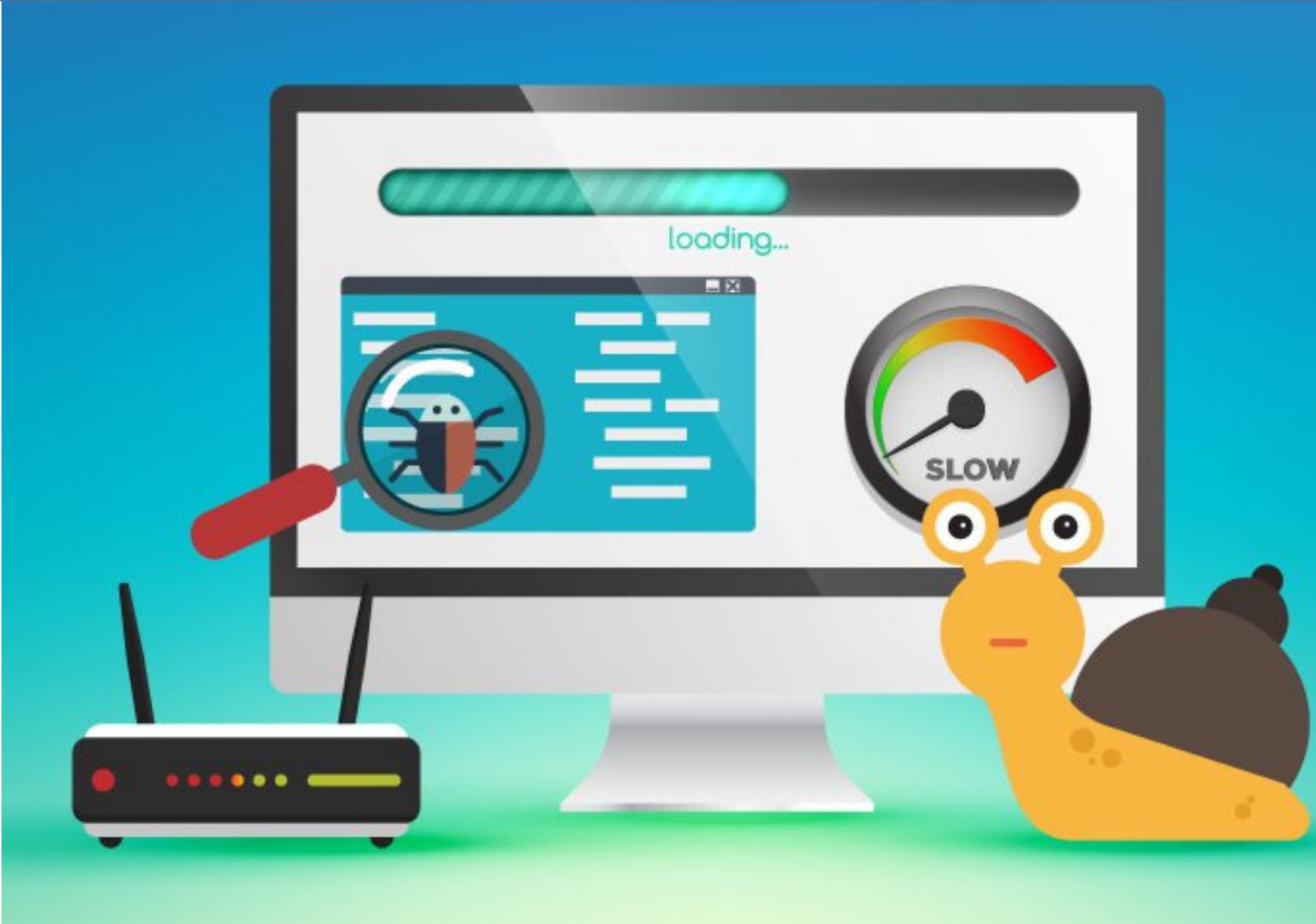
**TESTES E PERFORMANCE WEB**

TECNOLOGIAS E SISTEMAS DE INFORMAÇÃO PARA A WEB

**POLITÉCNICO  
DO PORTO  
ESCOLA  
SUPERIOR  
DE MEDIA ARTES E  
DESIGN**

## M01 – INTRODUCTION TO WEB PERFORMANCE

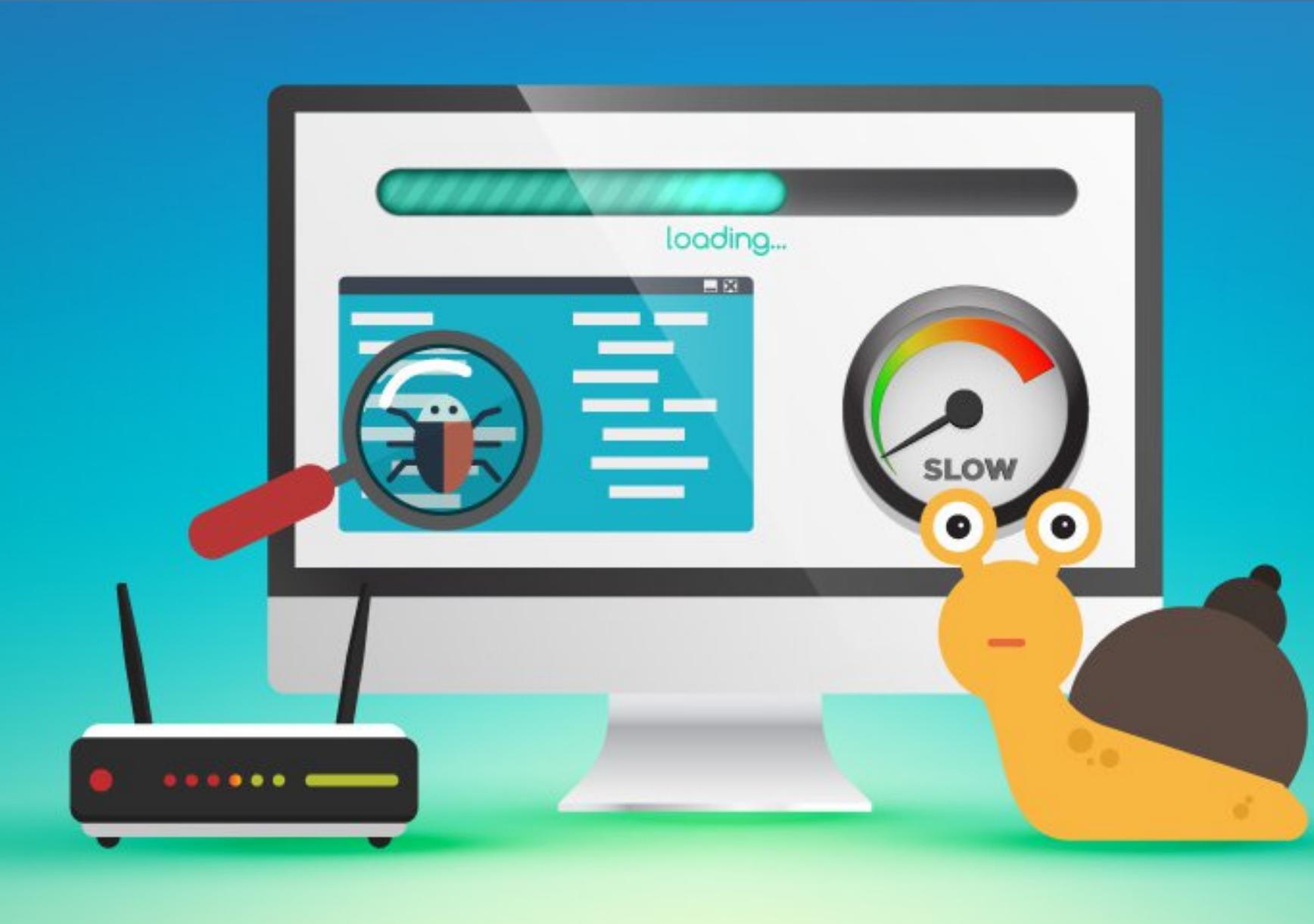
TSIW 2023/2024



## AGENDA

1. What is web performance;
2. What is the cost of a low performance;
3. Why speed is important;
4. Final remarks.

## WHAT IS WEB PERFORMANCE



## 1. WHAT IS WEB PERFORMANCE

- Web performance refers primarily to the speed at which a website loads;
- **Shorter load times improves the user experience:**
  - This way users are more likely to see what the website has to offer and helps achieve the website goals;
  - Slow websites will test the users' patience and may result in the abandoning of the website before they ever see what the website have to offer.

## 1. WHAT IS WEB PERFORMANCE

**Web performance rely on the following areas:**

- Reducing the overall load time;
- Making the website usable as soon as possible;
- Smoothness and interactivity;
- Perceived performance;
- Performance measurements.

## 1. WHAT IS WEB PERFORMANCE

- Web performance optimization (WPO), or website optimization is the field of knowledge that focuses on increasing web performance;
- Faster website download speeds have been related with the increase of visitors retention, loyalty, and, user satisfaction, primarily for users with slow internet connections and those on mobile devices;
- Web performance also leads to less data travelling across the web, which lowers the website power consumption and reduces the environmental impact.

## 1. WHAT IS WEB PERFORMANCE

### Web performance and user experience:

- High-performing websites improve the user experience;
- A faster website will deliver the content to user and because of that the user experience is better;
- Slow websites have a measurable effect on user engagement;
- On e-commerce websites, nearly half of users expect a website that loads in 2 seconds. 40% of users will exit if it takes more than 3 seconds to load. A 1 second delay in page response can mean a 7% reduction in users retention. This means loss of traffic and loss of revenue.

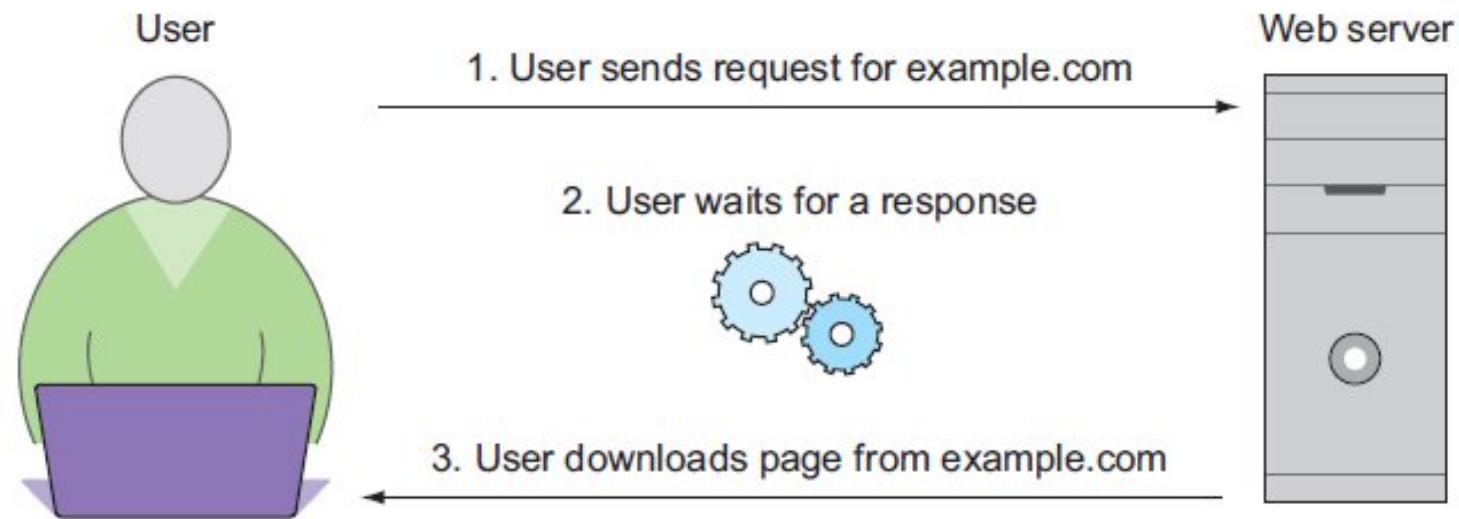
## 1. WHAT IS WEB PERFORMANCE

### Web performance and user experience:

- In addition, the performance of a website impacts not only users, but also, the website position in Google search position;
- In 2010, Google indicates that page speed is a factor in the positioning of the website in the ranking of the search results;
- Although the content is very important in the website's search ranking, page speed plays an important role.

## 1. WHAT IS WEB PERFORMANCE

### How websites load?



To know why web optimization is important, it is necessary to understand where the problem lies, and, how web browsers and server communicate.

## 1. WHAT IS WEB PERFORMANCE

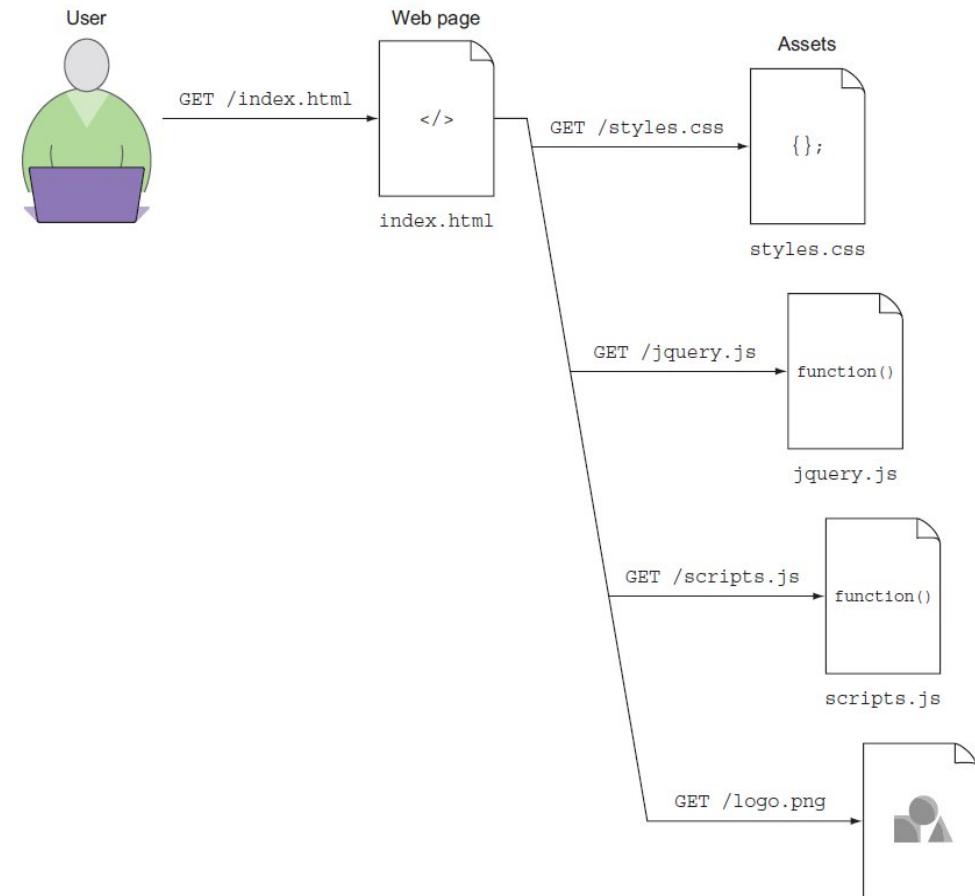
### How websites load?

- **Websites are often more complex than a single HTML file, they have:**
  - HTML to structure and define content;
  - CSS to add style to content;
  - JS to turn static pages to dynamic pages with some complex behaviours.
- That pieces come with a cost in terms of performance.

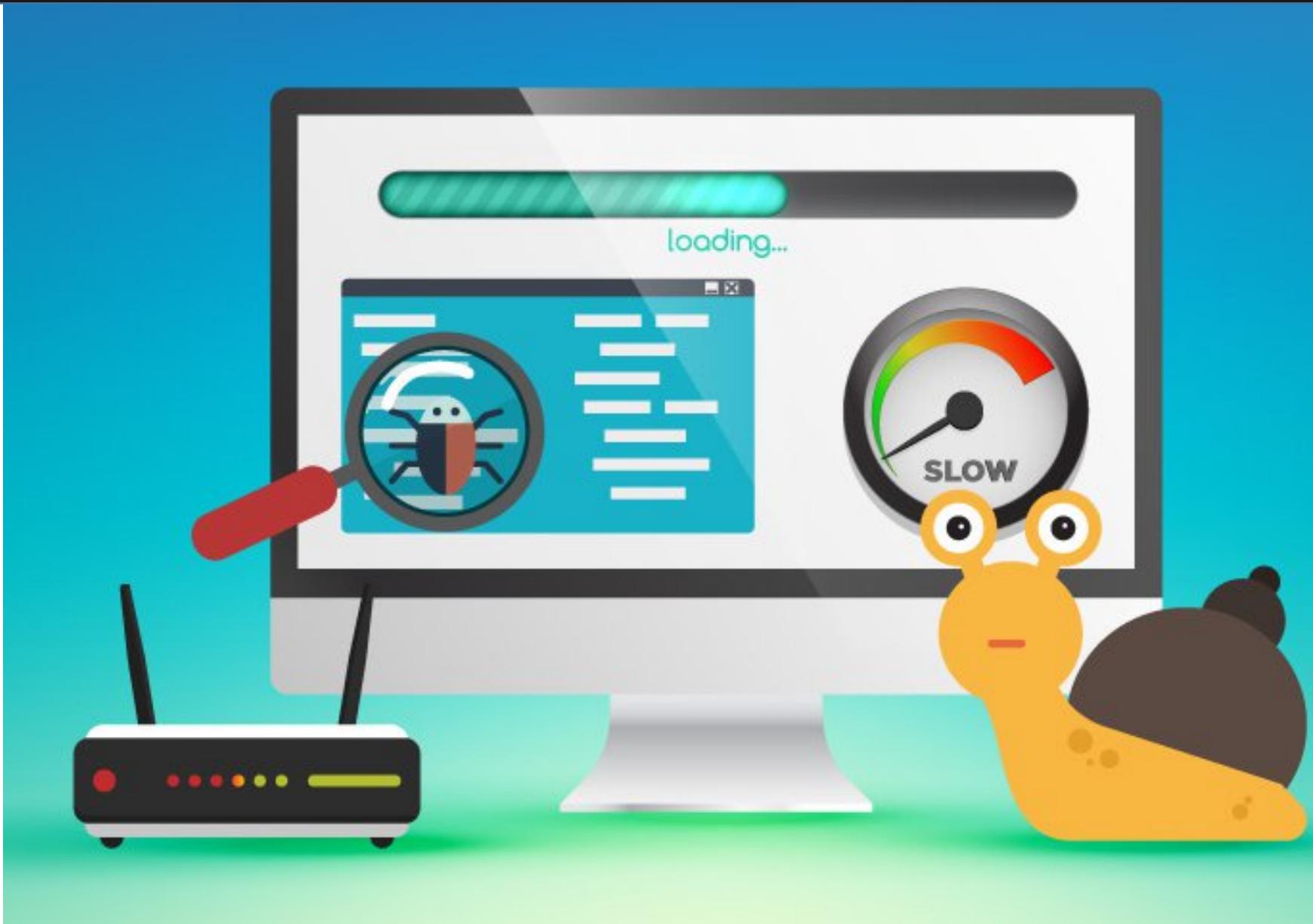
## 1. WHAT IS WEB PERFORMANCE

### How websites load?

- A user's request to get the index.html file transforms in several requests in order to retrieve the necessary CSS, JS files and other necessary assets;
- **Challenge of enhancing website performance:**
  - Balancing the requirements of a modern website with the importance of serving them as fast as possible;
  - Performing enhancement techniques to maintain the complex web and users experience.



## WHAT IS THE COST OF A LOW PERFORMANCE



## 2. WHAT IS THE COST OF A LOW PERFORMANCE

- Performance is a lower priority compared to others features;
- It's easy to add more and more functionalities to websites but optimizing and removing unnecessary junk is not so easy;
- Website developers are afraid to break the website or the visitors usage patterns, so it becomes easier to make excuses for not addressing performance.

## 2. WHAT IS THE COST OF A LOW PERFORMANCE

### Usual excuses:

- “We don’t have a performance problem”;
- “Our users never complain”;
- “Our users have a modern browser or high-end devices”;
- “We’ll address performance later”;
- “Some systems require more bandwidth and processing”;
- “Expanding page weight it the price of progress”;
- “Improving performance increases complications and maintenance”;
- “Our client is happy”.

## 2. WHAT IS THE COST OF A LOW PERFORMANCE

**Web obesity, slow downloads, and, poor performance hit everyone:**

- Website users;
- Online business owners;
- Even those who have never accessed the web.

**Costs at several levels:**

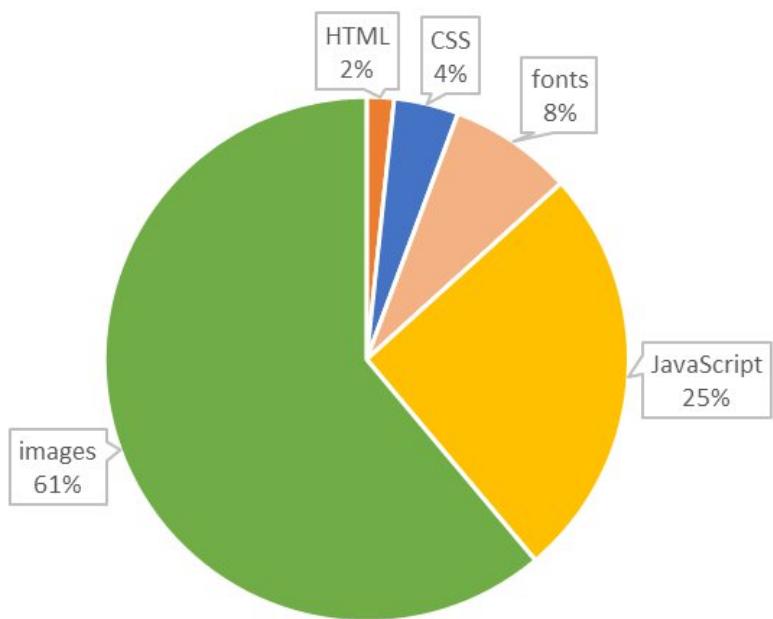
- User costs;
- Business costs;
- Environmental costs.

## 2. WHAT IS THE COST OF A LOW PERFORMANCE

### Users Costs (early 2020):

- 27Kb of HTML content;
- 64Kb of CSS split in 7 CSS Stylesheets;
- 122Kb of Fonts split in 4 Font Files;
- 410Kb of JS split in 20 JS Files;
- 31 images requiring 980Kb of bandwidth (a third of these are off screen and may never been viewed);
- Total of 1940Kb of data;
- 74 HTTP requests;
- 7 seconds to fully appear (desktop) and 20 seconds on mobile devices.

Average Page Weight 2020: 1,940Kb

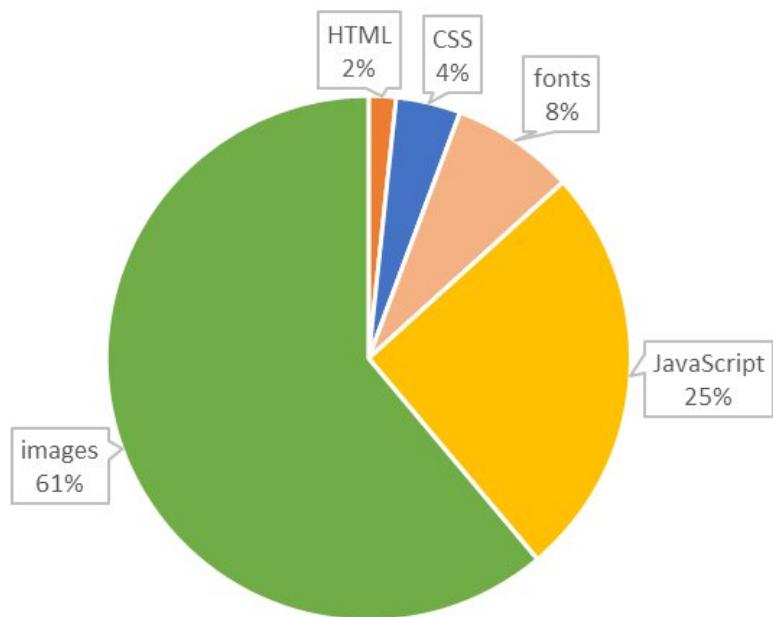


## 2. WHAT IS THE COST OF A LOW PERFORMANCE

### Users Costs (early 2020):

- Downloading this website on a typical mobile phone costs US users \$0.20;
- Those browsing in Mauritania and Madagascar pay more than 1% of their daily income for the privilege of viewing a simple website – despite it containing a mere 27Kb of potentially readable content.

Average Page Weight 2020: 1,940Kb



## 2. WHAT IS THE COST OF A LOW PERFORMANCE

### Business Costs:

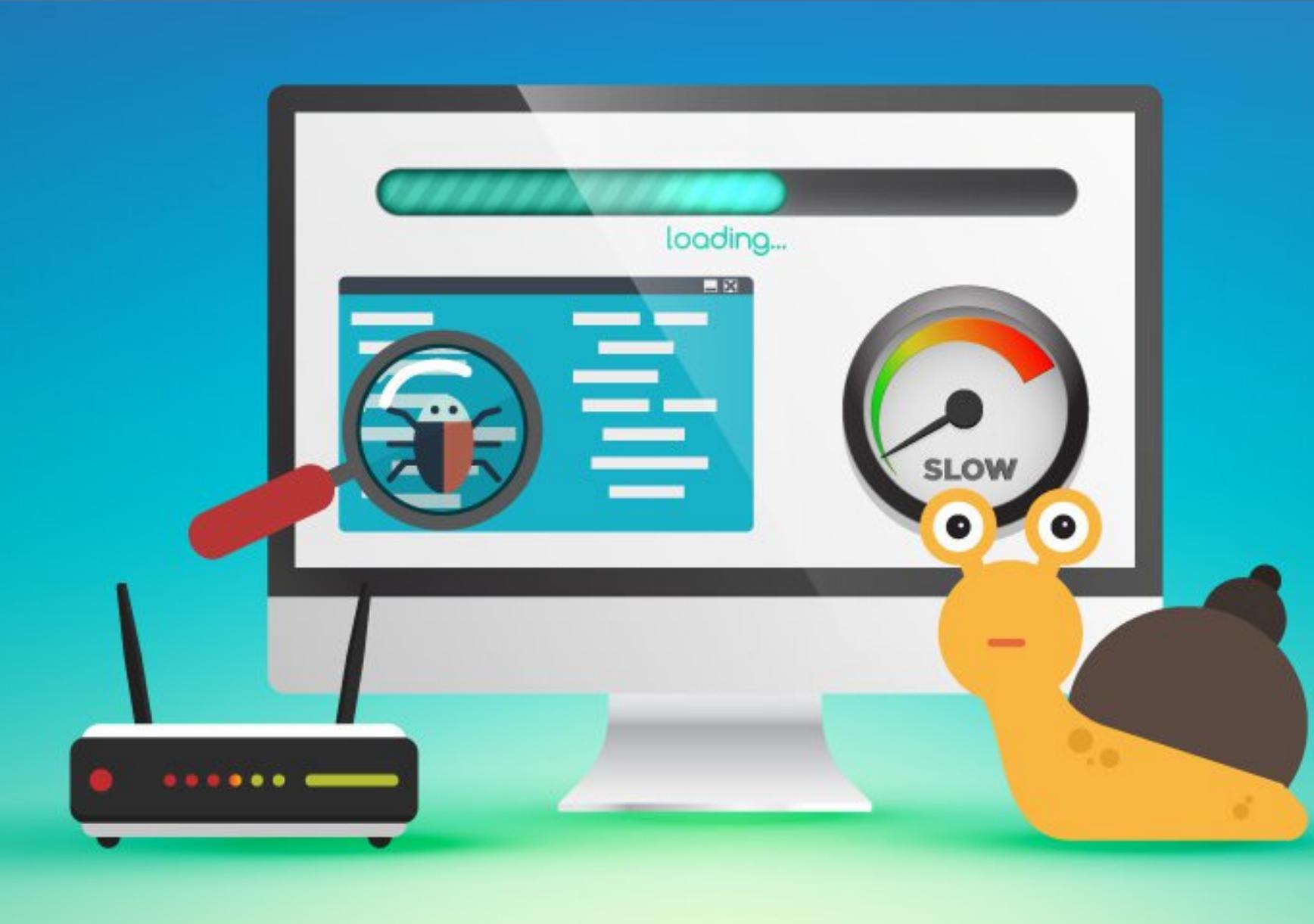
- The larger the page download, the slower the user experience, and the less likely that person will consider making a purchase or returning;
- 55% of the visitors use a mobile device. These have more limited capabilities and may be connected to a slower network, which exacerbates the problem;
- Google's page speed algorithms downgrade slower sites, which harms search engine optimization efforts;
- More data results in higher hosting, storage and bandwidth costs;
- The larger your codebase, the longer it takes to update and maintain.

## 2. WHAT IS THE COST OF A LOW PERFORMANCE

### Environmental Costs

- The internet consumes 420TWh – or up to - 10% of the world's electricity consumption. This accounts for 4% of global greenhouse gas emission, which is comparable to the aviation industry. Taking the web infrastructure and traffic into account, a single page load is estimated to emit 1.3g of CO<sup>2</sup>;
- While the web has reduced energy use by providing a virtual alternative to travel and postage, those 1MB hero images still have an environmental impact.

## WHY SPEED IS IMPORTANT



### 3. WHY SPEED IS IMPORTANT

#### Examples:

- **Cook** reduced average page load time by 850ms and because of that:
  - Increased conversions by 7%;
  - Decreased bounce rates by 7%;
  - Increased pages per session by 10%.



### 3. WHY SPEED IS IMPORTANT

#### Examples:

- **Pinterest** reduced perceived wait times by 40% and this increased search engine traffic and sign-ups by 15%.

*“Performance has directly impacted the company’s bottom line”*



- **BBC** found they lost an additional 10% of users for every additional second their site took to load.



### 3. WHY SPEED IS IMPORTANT

#### Examples:

- **Mobify** reported that for every 100ms reduction in homepage load speed results in:
  - 1.11% increase in session base conversion;
  - 380 000\$ increase in annual revenue.
- An additional 100ms reduction in checkout page load speed results in:
  - 1.55% increase in session base conversion;
  - 530 000\$ increase in annual revenue.



### 3. WHY SPEED IS IMPORTANT

#### Examples:

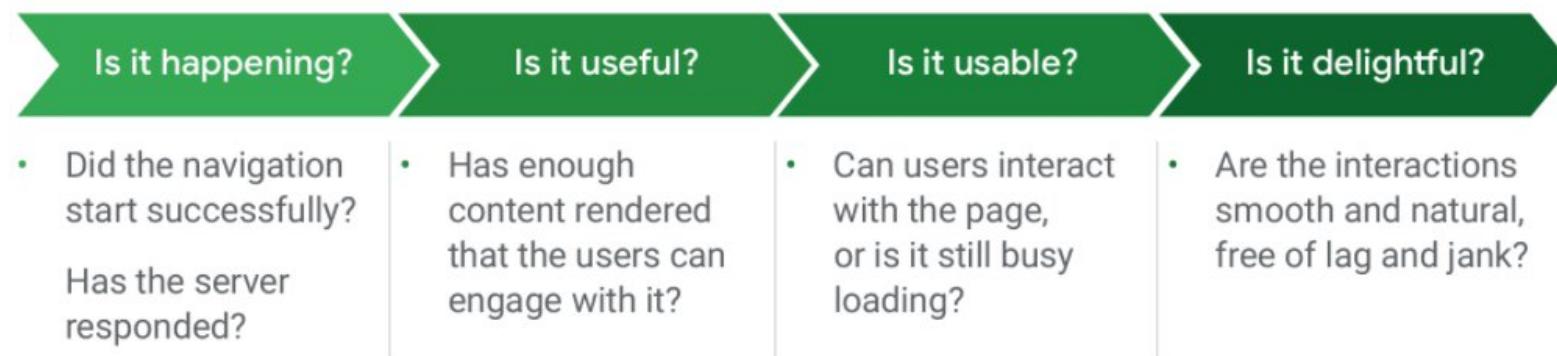
- **AutoAnything** reduced page load time by half and perceived a boost of 12% to 13% in sales.
- **Furniture Village** reduced page load time by 20% and perceived an increase in conversion rate by 10%.



### 3. WHY SPEED IS IMPORTANT

#### Speed Matters:

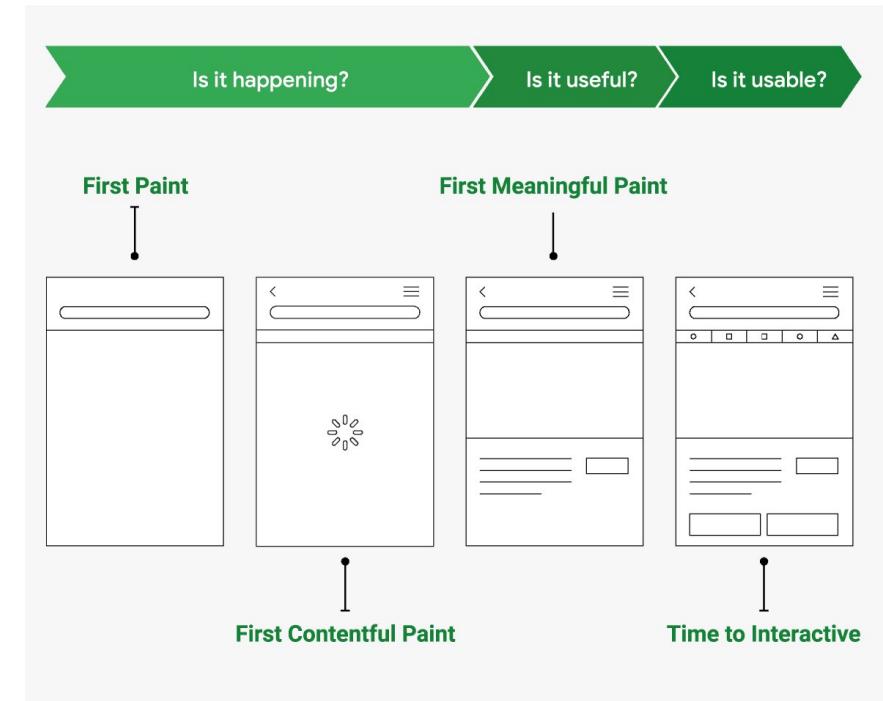
- There are multiple moments during the load experience that can affect whether a user perceives it as “fast”, and if you just focus solely on you, you might miss bad experiences that happen during the rest of the time;
- Rather than measuring load with just one metric, you should time each moment in the experience that affects the user’s perception of load time;
- When a user navigates to a web page, he looks for certain types of feedback;



### 3. WHY SPEED IS IMPORTANT

#### Speed Matters:

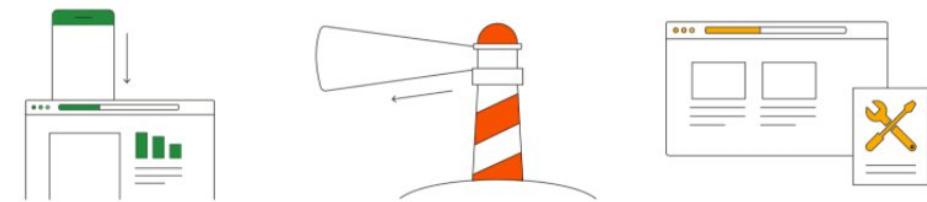
- Traditional performance metrics like load time are unreliable, since their occurrence may not correspond these feedback milestones;
- Additional metrics have emerged to understand when a page delivers this feedback to its users;



### 3. WHY SPEED IS IMPORTANT

#### How to measure speed:

- Real-world performance is highly variable due to differences in users' devices, network connections, and other factors;
- If you load a website using a cable network connection in your office and compares the load of the same website with the Wi-Fi of a coffee shop the experiences are likely to be very different;
- There are many tools that can be used to collect lab or field data to assess page performance;



### 3. WHY SPEED IS IMPORTANT

#### How to measure speed:

- **Lab Data:**
  - Collects data within a controlled environment with predefined device and network connection;
  - Offers reproducible results and a debugging environment, but might not capture real-world bottlenecks and cannot correlate against real-world page Key Performance Indicators (KPI's);
  - Need to understand your users' typical devices and networks and appropriately mirror those conditions when you test performance.

### 3. WHY SPEED IS IMPORTANT

#### How to measure speed:

- **Field Data (also called Real User Monitoring or RUM):**
  - Captures true real-world user experience;
  - Enables correlation to business KPI's, but has a restricted set of metrics and limited debugging capabilities.

### 3. WHY SPEED IS IMPORTANT

#### What tools to measure speed:

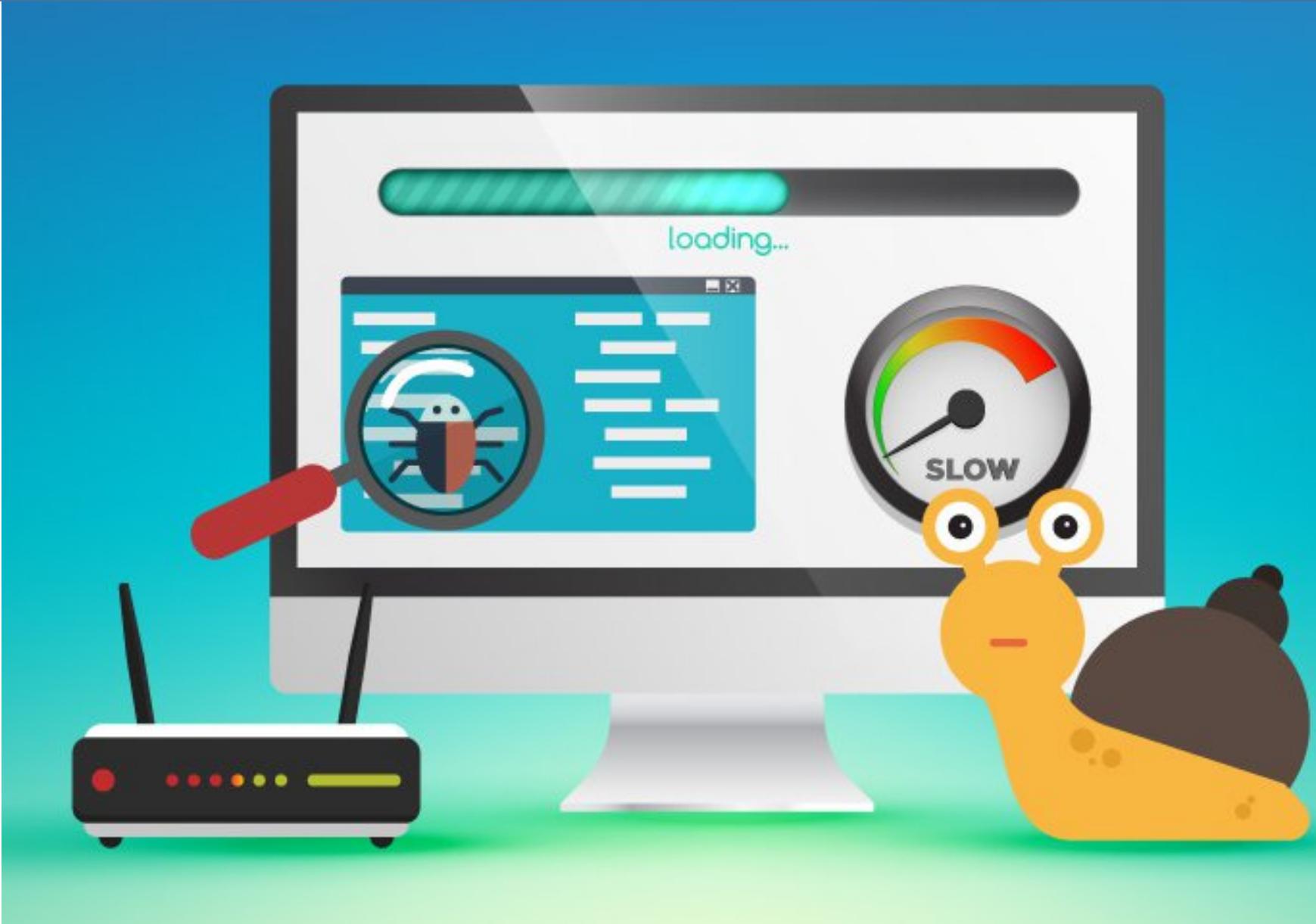
- **Lab Data:**
  - Lighthouse takes a URL and runs a series of audits against the page, generating a report on how well the page did.
- **Field Data:**
  - Chrome User Expert Report (CrUX) provides metrics about how real-world Chrome users experience popular destinations on the web.

### 3. WHY SPEED IS IMPORTANT

#### What tools to measure speed:

- **Other Tools:**
  - PageSpeed Insights provides both lab and field data about a page;
  - Chrome Developer Tools is a set of tools built directly into the Chrome Browser. It allows you to profile the run time of a page, as well as identify and debug performance bottlenecks.

## FINAL REMARKS



## 4. FINAL REMARKS

- When building a modern web experience, it is important to measure, optimize, and monitor the performance of the website;
- Performance plays an important role to engage and retain visitors;
- Websites should focus on optimizing for user-centric happiness metrics;
- To “stay-fast”, set and enforce performance budgets to help your team work within the constraints to continue loading fast and keeping visitors happy;
- So it is important to figure out:
  - Which metrics should a website follow?
  - What tools should be used to measure those metrics?