

Evolution Of Wdt: Speed Change in Web Development Technology

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ABSTRACT

The web development technology is characterized by relentless innovation and rapid evolution. This research explores the landscape dynamic nature of this field, investigating the myriad factors driving change and the implications for developers, businesses, and society. Through a historical lens, we trace the evolution of web development from its nascent stages to the present, identifying key technological advancements. We see the frameworks, libraries, automation tools, and emerging paradigms such as responsive design, API-driven development, and microservices architecture in accelerating the pace of development. This research contributes to a deeper understanding of speed change in web development technology and its profound impact on the digital ecosystem.

I. INTRODUCTION

The World Wide Web has undergone a remarkable transformation since its inception, evolving from static pages of text to dynamic, interactive experiences that permeate nearly every aspect of modern life. This evolution has been driven by a relentless cycle of innovation in web development technology, characterized by the constant introduction of new tools, frameworks, and paradigms. The speed at which these changes occur presents both opportunities and challenges for developers, businesses, and society at large. This research seeks to delve into the phenomenon of rapid change in web development technology and future trajectories. By tracing the historical evolution of web development from its early days to the present. From the advent of HTML and CSS to the emergence of JavaScript frameworks and cloud computing, each milestone has contributed to the acceleration of development cycles and the proliferation of innovative web experiences. Central to our exploration is an analysis of the factors driving change in web development technology. We tell you about updates in web standards, and the emergence of new programming languages and frameworks have collectively fueled the rapid pace of innovation. Additionally, we investigate the role of automation, tooling, and best practices such as DevOps and many other. Furthermore, this research explores the impact of rapid technological change on developers, businesses, and society. we highlight the opportunities for increased productivity, scalability, and competitiveness that arise from embracing new tools and methodologies.

1. Evolution of Web Development Technology

The evolution of web development technology has been marked by a series of transformative changes, each driven by technological advancements, changing user behaviors, and industry trends. Here is an overview of the key technology changes from the early days of the World Wide Web to the present:

a. HTML and Static Web Pages (1989-1995):

In 1989, Tim Berners-Lee invented the World Wide Web, laying the groundwork for the development of HTML (Hypertext Markup Language) in 1991.

HTML provided a standardized way to create and format web pages, allowing users to link documents together via hyperlinks. Early websites consisted mainly of static content, comprising text and simple graphics.

b. Introduction of CSS and JavaScript (1996-2000):

Cascading Style Sheets (CSS) emerged in the mid-1990s means to separate the presentation and structure of web pages, enabling more sophisticated visual designs.

JavaScript, introduced in 1995, revolutionized web development by allowing developers to create interactive and dynamic content within web pages, such as form validation and animations.

c. Browser Wars and Dynamic Content (Late 1990s):

The late 1990s saw intense competition between web browsers, notably Netscape Navigator and Microsoft Internet Explorer, leading to rapid innovation in web technologies.

Server-side scripting languages like PHP, Perl, and ASP (Active Server Pages) enabled the generation of dynamic content, paving the way for the development of web applications.

d. Web 2.0 and AJAX (Early 2000s):

Web 2.0, a term coined in the early 2000s, ushered in an era of user-generated content, social networking, and interactive web applications.

AJAX (Asynchronous JavaScript and XML) emerged as a key technology, enabling web pages to fetch and display data asynchronously without requiring a full page reload, resulting in smoother and more responsive user experiences.

e. Frameworks and Libraries (Mid-2000s to Present):

The mid-2000s saw the rise of **JavaScript frameworks and libraries such as jQuery, Prototype, and later AngularJS, React, and Vue.js.**

These frameworks streamlined web development by providing reusable components, data binding, and other features to simplify the creation of complex, interactive web applications.

f. Responsive Design and Mobile-First Development (2010s):

The proliferation of smartphones and tablets in the 2010s prompted a shift towards mobile-first development strategies and responsive web design. **Frameworks like Bootstrap and Foundation** gained popularity for their grid systems and responsive components, enabling developers to create websites that adapt seamlessly to various screen sizes and devices.

g. Modern Trends and Technologies (Present):

Modern web development is characterized by trends such as Progressive Web Apps (PWAs), which combine the best features of web and native mobile applications to deliver fast, engaging user experiences.

Headless CMS (Content Management Systems) have gained traction, allowing developers to decouple content creation and delivery and build flexible, customizable frontends using technologies like GraphQL and serverless architecture.

1.1. Current Scenario

In the current scenario, web development technology continues to evolve at a rapid pace, driven by

emerging trends, technological advancements, and shifting user expectations. Here are some key aspects of the current landscape:

2.1.1 JavaScript Dominance: JavaScript remains the cornerstone of web development, with widespread adoption across both frontend and backend development. Frameworks like React, Angular, and Vue.js continue to be popular choices for building dynamic, interactive user interfaces.

2.1.2 Serverless Architecture: Serverless computing has gained traction, offering developers the ability to build and deploy applications without managing server infrastructure. Platforms like AWS Lambda, Google Cloud Functions, and Azure Functions enable scalable and cost-effective solutions.

2.1.3 Progressive Web Apps (PWAs): PWAs combine the best features of web and native mobile applications, offering fast, reliable, and engaging user experiences. They leverage technologies such as service workers, push notifications, and offline support to deliver app-like experiences on the web.

2.1.4 Single Page Applications (SPAs): SPAs continue to be popular for building responsive and fluid user interfaces. They load content dynamically, minimizing page refreshes and providing a smoother browsing experience. Frameworks like React, Angular, and Vue.js are commonly used for SPA development.

2.1.5 Microservices Architecture: Microservices architecture is widely adopted for building scalable and resilient web applications. It involves breaking down applications into smaller, independently deployable services, allowing for easier development, deployment, and maintenance.

2.1.6 Containerization and Orchestration: Containerization technologies like Docker and container orchestration platforms like Kubernetes have become integral parts of modern web development workflows. They enable developers to build, deploy, and manage applications more efficiently across different environments.

2.1.7 GraphQL: GraphQL has emerged as a popular alternative to traditional REST APIs for querying and manipulating data. It provides a more flexible and efficient way to fetch data, allowing clients to request only the data they need in a single request.

2.1.8 Static Site Generators (SSGs): SSGs have gained popularity for building fast and secure websites. They generate static HTML files at build

time, reducing server load and improving performance, security, and SEO.

2.1.9 Headless CMS: Headless CMS solutions decouple content management from presentation, enabling developers to build flexible and customizable frontends using technologies like GraphQL. They offer greater control and flexibility over content delivery while maintaining a familiar editing experience for content creators.

2.1.10 Accessibility and Inclusivity: There is a growing emphasis on building web experiences that are accessible to users of all abilities. Developers are incorporating best practices and tools for ensuring web accessibility, such as semantic HTML, ARIA roles, and automated testing tools.

Overall, the current scenario in web development is characterized by a focus on performance, scalability, and user experience, driven by advancements in technology and a commitment to meeting the evolving needs of users and businesses alike.

1.2. AI in Web Development

Artificial Intelligence (AI) is increasingly being integrated into various aspects of web development, offering new opportunities to enhance user experiences, automate tasks, and improve the efficiency of web applications. Here is some key ways AI is impacting web development.

2.2.1 Chatbots and Virtual Assistants:

AI-powered chatbots and virtual assistants are becoming common features on websites and web applications. These intelligent agents use natural language processing (NLP) and machine learning algorithms to understand user queries and provide personalized assistance, such as answering questions, providing product recommendations, and guiding users through the website.

2.2.2 Personalization and Recommendations:

AI algorithms analyze user behavior, preferences, and past interactions to deliver personalized content and recommendations. This can include personalized product recommendations on e-commerce websites, content recommendations on news websites, and tailored experiences based on user preferences.

2.2.3 Predictive Analytics:

AI enables predictive analytics capabilities in web applications, allowing businesses to anticipate user behavior and trends. By analyzing large datasets and historical patterns, AI algorithms can forecast future

outcomes, identify potential opportunities, and make data-driven decisions to optimize website performance and user engagement.

2.2.4 Content Generation and Curation:

AI technologies, such as natural language generation (NLG), can automatically generate content for websites, including articles, product descriptions, and social media posts. AI algorithms can also curate and organize content based on relevance, popularity, and user interests, improving the discoverability and engagement of web content.

2.2.5 Automated Testing and Debugging:

AI-powered testing tools automate the process of testing web applications for bugs, errors, and performance issues. Machine learning algorithms can analyze code, identify potential vulnerabilities, and suggest optimizations to improve the reliability and security of web applications.

2.2.6 Image and Voice Recognition:

AI enables advanced image and voice recognition capabilities in web applications, allowing users to interact with websites using visual or voice commands. This can include features such as image search, facial recognition, and voice-based navigation, enhancing the accessibility and usability of web interfaces.

2.2.7 Natural Language Processing (NLP):

NLP technologies enable web applications to understand and process human language, allowing for natural and conversational interactions. NLP-powered features include sentiment analysis, language translation, text summarization, and sentiment-based content moderation.

2.2.8 Smart Content Management Systems (CMS):

AI-powered content management systems (CMS) use machine learning algorithms to analyze and optimize content based on user engagement metrics, search engine optimization (SEO) criteria, and content performance data. These smart CMS platforms automate content creation, distribution, and optimization tasks, enabling more efficient content management workflows.

Overall, AI is revolutionizing web development by enabling smarter, more personalized, and more efficient web experiences. As AI technologies continue to evolve and mature, web developers will have new tools and capabilities to create innovative

and impactful web applications that meet the evolving needs of users and businesses.

1.3. AI Tools

There are several AI tools and platforms that web developers can leverage to enhance their workflow, improve productivity, and add intelligent features to web applications. Here are some popular AI tools for web development:

2.3.1 TensorFlow.js:

TensorFlow.js is an open-source library for training and deploying machine learning models in JavaScript environments, including web browsers and Node.js. It allows developers to build and run AI models directly in the browser, enabling features such as image recognition, natural language processing, and predictive analytics in web applications.

2.3.2 Brain.js:

Brain.js is a lightweight JavaScript library for building and training neural networks in web applications. It provides a simple API for creating and training neural networks using JavaScript, enabling developers to add AI-powered features such as pattern recognition, predictive modeling, and decision-making to web applications.

2.3.3 Dialogflow:

Dialogflow, part of Google Cloud Platform, is a natural language understanding platform that enables developers to build conversational interfaces, such as chatbots and virtual assistants. It uses machine learning algorithms to understand user queries and generate appropriate responses, making it easy to create AI-powered chatbots for web applications.

2.3.4 IBM Watson:

IBM Watson is a suite of AI-powered services and tools that developers can integrate into web applications to add advanced AI capabilities. Watson services include natural language understanding, speech recognition, image analysis, sentiment analysis, and more, allowing developers to create intelligent and personalized web experiences.

2.3.5 Azure Cognitive Services:

Azure Cognitive Services, part of Microsoft Azure, provides a collection of AI-powered APIs and services that developers can use to add intelligent features to web applications. Cognitive Services include vision, speech, language, and decision APIs, enabling developers to incorporate capabilities such

as image recognition, speech-to-text, language translation, and text analytics into web applications.

2.3.6 OpenAI GPT (Generative Pre-trained Transformer):

OpenAI GPT is a state-of-the-art natural language processing model that can generate human-like text based on input prompts. Developers can use GPT models to generate text content, perform language translation, summarize text, and more, making it a powerful tool for enhancing the content generation capabilities of web applications.

2.3.7 Lobe:

Lobe is a no-code platform for building custom machine learning models using a visual interface. It allows developers to train models for image classification, object detection, and other tasks using a simple drag-and-drop interface, making it easy to integrate AI-powered image recognition capabilities into web applications.

2.3.8 Hugging Face Transformers:

Hugging Face Transformers is an open-source library for natural language processing (NLP) that provides pre-trained models for various NLP tasks. Developers can use Transformers models to perform tasks such as text classification, named entity recognition, sentiment analysis, and more, enhancing the language processing capabilities of web applications.

These are just a few examples of AI tools and platforms that web developers can leverage to incorporate AI capabilities into web applications. By integrating these tools into their workflow, developers can create intelligent and interactive web experiences that provide value to users and businesses alike.

2. Future Technology Emerging in Web Development

The future of web development technology holds exciting possibilities, driven by emerging trends, advancements in technology, and evolving user needs. Here are some key areas where we can expect to see significant developments in the coming years:

3.1 Web Assembly (Wasm):

Web Assembly is a binary instruction format that enables high-performance execution of code on the web. It allows developers to compile code written in languages like C, C++, and Rust to run in web browsers at near-native speeds. In the future, Web Assembly is expected to enable a new generation of

web applications with richer features and better performance, including complex games, multimedia applications, and productivity tools.

3.2 AI and Machine Learning:

Artificial Intelligence (AI) and Machine Learning (ML) technologies are increasingly being integrated into web development workflows to enhance user experiences and automate tasks.

In the future, we can expect to see AI-powered features such as personalized content recommendations, natural language processing for chatbots and virtual assistants, and predictive analytics for user behavior.

3.3 Augmented Reality (AR) and Virtual Reality (VR):

AR and VR technologies are poised to revolutionize the way we interact with web content, providing immersive and interactive experiences.

In the future, we can anticipate web applications that leverage AR and VR for gaming, education, training, virtual tours, and virtual meetings, blurring the lines between the digital and physical worlds.

3.4 Blockchain and Decentralized Web:

Blockchain technology offers the potential to create decentralized, tamper-proof systems for identity verification, data storage, and transactions.

In the future, we may see the emergence of decentralized web applications (dApps) that leverage blockchain for secure and transparent interactions, such as decentralized social networks, marketplaces, and financial services.

3.5 Internet of Things (IoT):

The Internet of Things (IoT) is a growing ecosystem of interconnected devices that communicate and interact with each other over the internet. In the future, web development will play a crucial role in building interfaces and applications that enable users to control and monitor IoT devices from web browsers, as well as facilitating data exchange and interoperability between devices.

3.6 Voice Interfaces and Conversational UI:

Voice interfaces and conversational user interfaces (UI) are becoming increasingly popular, driven by the widespread adoption of virtual assistants like Siri, Alexa, and Google Assistant.

In the future, web developers will need to adapt to designing and developing web applications that support voice commands, natural language processing, and conversational interactions, offering seamless experiences across devices.

3.7 Edge Computing:

Edge computing brings computational power closer to the source of data generation, reducing latency and enabling real-time processing and analysis.

In the future, edge computing will enable web developers to build applications that leverage edge resources for faster response times, improved reliability, and enhanced privacy and security.

3.8 Ethical and Sustainable Web Development:

There is growing awareness and concern about the environmental impact and ethical implications of web development practices, such as energy consumption, data privacy, and digital inclusion.

In the future, web developers will need to prioritize ethical and sustainable practices, such as optimizing energy usage, minimizing data collection, and tracking, and designing inclusive and accessible experiences for all users.

Overall, the future of web development technology holds tremendous potential for innovation and creativity, as developers continue to push the boundaries of what is possible on the web. By staying abreast of emerging trends and technologies, web developers can prepare themselves to embrace new opportunities and shape the future of the digital landscape.

3. Market Scenario of Web Development

4.1 Demand in market from initial to till now

Understanding the demand for web development skills from its inception to the present day involves tracing the evolution of the internet and its integration into various aspects of society.

Here is a simplified overview:

4.1.1 Initial Phase (1990s - Early 2000s):

In the early days of the internet, demand for web development skills was relatively low compared to today. The web was

primarily used for sharing static content, such as text-based websites and basic images.

Businesses started recognizing the potential of the internet for reaching customers and establishing an online presence, leading to a gradual increase in demand for web developers who could create simple, static websites.

4.1.2 Dot-com Boom (Late 1990s):

The dot-com boom of the late 1990s saw a surge in demand for web development skills as businesses rushed to establish an online presence and capitalize on the growing popularity of the internet.

Demand was particularly high for developers who could create visually appealing websites and incorporate basic interactivity using technologies like HTML, CSS, and JavaScript.

4.1.3 Web 2.0 Era (Mid-2000s):

The emergence of Web 2.0 in the mid-2000s brought about a shift towards more dynamic and interactive web experiences. Demand for web developers increased as businesses sought to create web applications with features such as user-generated content, social networking, and multimedia.

Technologies like AJAX (Asynchronous JavaScript and XML) enabled smoother, more responsive user experiences, leading to a growing demand for developers with skills in frontend development and JavaScript.

4.1.4 Mobile Revolution (Late 2000s - Early 2010s):

The proliferation of smartphones and mobile devices in the late 2000s and early 2010s drove demand for web developers who could create mobile-friendly websites and web applications.

Responsive web design became a key consideration as businesses recognized the importance of providing consistent and optimized experiences across various screen sizes and devices.

4.1.5 Modern Era (Mid-2010s - Present):

In the current era, demand for web development skills continues to grow as the internet becomes increasingly integral to everyday life. Businesses of all sizes rely on websites and web applications for everything from marketing and e-commerce to communication and collaboration.

The rise of new technologies and frameworks, such as React, Angular, and Vue.js, has fueled demand for developers with expertise in frontend and backend development, as well as full-stack development.

Throughout this journey, the demand for web development skills has evolved in response to advancements in technology, changes in user behavior, and shifts in business priorities. From the early days of static websites to the dynamic and interactive web experiences of today, web developers have played a crucial role in shaping the digital landscape.

4.2 Future Demands in web Development

The future of web development is poised for continued growth and evolution, driven by emerging technologies, changing user behaviors, and evolving business needs. Here are some areas where future demand in web development is likely to be particularly strong:

4.2.1 Mobile Optimization:

With the increasing use of smartphones and tablets for accessing the internet, there will be a growing demand for web developers who specialize in mobile optimization. Businesses will need responsive and mobile-friendly websites and web applications to cater to users on various devices and screen sizes.

4.2.2 Progressive Web Apps (PWAs):

PWAs offer a blend of the web and native mobile applications, providing fast, reliable, and engaging user experiences. As businesses seek to deliver app-like experiences on the web, there will be a demand for web developers who can build and optimize PWAs using technologies like service workers, push notifications, and offline support.

4.2.3 E-commerce and Online Marketplaces:

The e-commerce industry continues to grow rapidly, driven by the convenience and accessibility of online shopping. Web developers with expertise in building and maintaining e-commerce platforms, online marketplaces, and payment gateways will be in high demand as businesses seek to capitalize on the growing trend of online retail.

4.2.4 Cybersecurity and Data Privacy:

With the increasing frequency and sophistication of cyber-attacks and data breaches, there will be a growing demand for web developers with expertise in cybersecurity and data privacy. Businesses will need to prioritize security measures such as

encryption, secure authentication, and regular security audits to protect sensitive data and maintain user trust.

4.2.5 Artificial Intelligence (AI) and Machine Learning (ML):

AI and ML technologies are increasingly being integrated into web applications to enhance user experiences, automate tasks, and provide personalized recommendations. Web developers with skills in AI and ML will be in demand to develop and implement intelligent features such as chatbots, recommendation engines, and predictive analytics.

4.2.6 Accessibility and Inclusivity:

There is a growing recognition of the importance of web accessibility and inclusivity, ensuring that websites and web applications are usable by all individuals, including those with disabilities. Web developers with expertise in accessibility standards, such as WCAG (Web Content Accessibility Guidelines), will be in demand to design, develop, and audit accessible web experiences.

4.2.7 Voice Interfaces and Natural Language Processing (NLP):

Voice interfaces and NLP technologies are becoming increasingly popular, driven by the widespread adoption of virtual assistants like Siri, Alexa, and Google Assistant. Web developers with skills

in voice UI design, speech recognition, and NLP will be in demand to create voice-enabled web applications and chatbots that provide natural and intuitive interactions.

4.2.8 Blockchain and Cryptocurrency:

Blockchain technology offers the potential to revolutionize various industries, including finance, supply chain, and healthcare. Web developers with expertise in blockchain development, smart contracts, and cryptocurrency integration will be in demand to build decentralized applications (dApps) and implement blockchain solutions for businesses.

Overall, the future demand for web developers will be shaped by emerging technologies, changing user expectations, and evolving industry trends. Developers who stay abreast of these developments and continually update their skills will be well-positioned to capitalize on the opportunities presented by the evolving landscape of web development.

4.3 career opportunities in Web Development

The field of web development offers a wide range of career opportunities, from entry-level positions to specialized roles requiring advanced skills and

experience. Here are some common career paths and opportunities in web development:

4.3.1 Frontend Developer:

Frontend developers focus on building the user interface and user experience of websites and web applications. They work with HTML, CSS, and JavaScript to create responsive and interactive interfaces that users interact with directly.

4.3.2 Backend Developer:

Backend developers are responsible for building and maintaining the server-side logic and databases that power websites and web applications. They work with server-side programming languages like JavaScript (Node.js), Python, Ruby, PHP, or Java, along with databases like MySQL, PostgreSQL, MongoDB, or Firebase.

4.3.3 Full-Stack Developer:

Full-stack developers have proficiency in both frontend and backend development, allowing them to work on all aspects of a web application. They are capable of building and deploying entire applications from the frontend to the backend.

4.3.4 Mobile Web Developer:

Mobile web developers specialize in creating web applications optimized for mobile devices. They often work with frameworks like React Native or Ionic to build cross-platform mobile applications using web technologies like HTML, CSS, and JavaScript.

4.3.5 UI/UX Designer:

UI/UX designers focus on creating intuitive and visually appealing user interfaces and experiences. They collaborate with developers to design wireframes, prototypes, and user interfaces that prioritize usability and accessibility.

4.3.6 DevOps Engineer:

DevOps engineers focus on automating and streamlining the processes of building, deploying, and maintaining web applications. They work with tools like Docker, Kubernetes, Jenkins, and Git to implement continuous integration, continuous delivery, and infrastructure as code practices.

4.3.7 Quality Assurance (QA) Engineer:

QA engineers are responsible for testing and ensuring the quality and reliability of web applications. They write test cases, perform manual and automated

testing, and identify and report bugs to developers for resolution.

4.3.8 Technical Project Manager:

Technical project managers oversee the planning, execution, and delivery of web development projects. They coordinate with cross-functional teams, manage resources and timelines, and ensure that projects are completed on time and within budget.

4.3.9 Freelancer/Contractor:

Many web developers choose to work as freelancers or contractors, offering their services to clients on a project-by-project basis. This allows for flexibility in work schedule, project selection, and potentially higher earning potential.

Overall, the field of web development offers diverse and rewarding career opportunities for individuals with a passion for technology, creativity, and problem-solving. Whether you are interested in frontend development, backend development, or a combination of both, there are ample opportunities to build a successful and fulfilling career in web development.

4. Growth of Web Development Industry

As of 2023, there are more than 200 million websites active worldwide, which is just below 20% of the total websites on the internet. Couple that with more than 5.1 billion internet users worldwide, and having a website is one of the best ways to put forward your brand and offerings.

That has meant a dramatic growth in the in the employment of web developers, projected to grow by 16% between 2022 and 2023. This number is much bigger than most of the industries and areas of employment.

The growth of the industry does not look like it will slow down anytime soon. Skilled web Development experts are essential in creating the digital landscape of future. There are plenty of chances for those venturing into the field.

6. Number of Web Developer are there in the world

As I mentioned earlier that its quite difficult to determine and specify number of web developer worldwide.

The estimated number of web developers according to the country.

Country	Number of Developers
India	5.8 million
USA	4.4million
Germany	9,01,000
UK	4,08,000
Vietnam	3,50,000
Poland	2,50,000
Mexico	2,23,000
Ukraine	2,12,000
Singapore	2,12,000
Sweden	1,80,000

5. Conclusion

In conclusion, this research paper has shed light on the rapid evolution of web development technology and the significant impact it has on speed. Through an in-depth analysis of various methodologies, frameworks, and tools, it is evident that embracing newer technologies such as serverless architecture, single-page applications, and content delivery networks can greatly enhance website performance and user experience. However, it is essential for developers to continually adapt and stay updated with the latest advancements in the field to effectively leverage speed improvements. As the digital landscape continues to evolve, the pursuit of faster, more efficient web development practices remains crucial for meeting the growing demands of users and businesses alike

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