



ENHANCING SOFTWARE QUALITY

TESTING APPROACH FOR WEB ACCESSIBILITY

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1 Abstract

Lately, there is a significant growth in web users across the globe. Besides using social networks, chats and emails; people have started paying utility bills, filing income tax, renewing passports, renewal of all security benefits, e-learning, net banking, shopping, etc.

All customer facing applications and systems are acute to any organization from revenue and customer satisfaction standpoint; and taking it a little serious could benefit in the long-run. The websites should be accessed by wide range of people, starting from regular users to those who need help of assistive technologies. Having said that, how many websites today are accessible?

Section 508 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) require that the web applications, web sites and documents developed/procured/maintained by organizations are accessible to all users – including those with certain disabilities.

So, evaluating the web application against the standard is important in order to make it comply with legislation to reduce legal liabilities. There are various approaches followed and evaluating websites for accessibility is a multi-page resource suite; this paper introduces Indium's approach for evaluating web accessibility.

The scope of this paper is to point out the accessible barriers, challenges and risks involved in testing approach by following accessibility standards and how to overcome them by using the web accessibility testing approach thereby evaluating the website is accessible to everyone. Our approach elucidates the effectiveness of open source evaluation tool and human judgment involvement in accessibility testing.

The study will help you understand the guidelines and importance of web accessibility and also gives some easy way of web accessibility testing approach on how to achieve the accessibility level of the Web content by overcoming the challenges, risks, cost and resources.

2 Web Accessibility

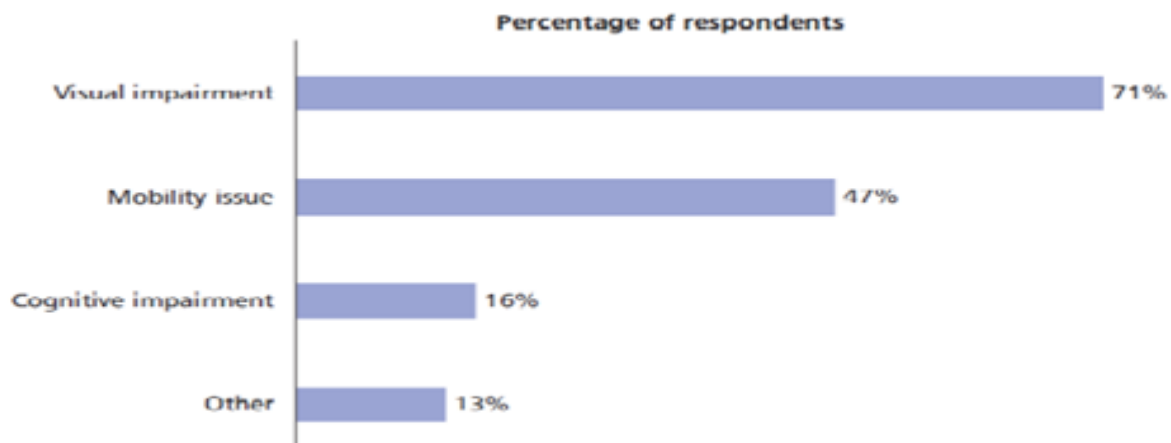
2.1 Introduction

Though numbers are difficult to estimate, recent studies have found that about one fifth (20%) of all people have some kind of disability. While not all disabilities affect a person's ability to use the Web, we must recognize that a significant portion of the population with visual, hearing, motor or cognitive disabilities are unable to access the Internet by traditional means. As information providers, we are obligated, both ethically and legally, to address the needs of people with disabilities when putting content on the Web.

- Web accessibility is the solution which answers the motivation to accomplish the goals of accessibility
- Understanding the user's perspective and needs
- Moving beyond technical accessibility
- Focusing on the principles of accessibility

2.2 What is Web Accessibility?

Web accessibility means that the specially enabled people can use the Web. Web accessibility encompasses all disabilities that affect access to the Web, including visual, auditory and physical, speech, cognitive and neurological disabilities.



Millions of specially enabled people are finding difficult to use their Web. Currently most Web sites and Web software have accessibility barriers that make it difficult or impossible for many specially enabled people to use the Web.

A key principle of Web accessibility is to evaluate the web sites that are flexible to meet the social factors, technical factors, legal and policy factors.

2.3 Why Web Accessibility?

The Web is an increasingly important resource in many aspects of life: education, employment, government, commerce, health care, recreation and more. It is essential that the Web be accessible in order to provide equal access and equal opportunity to specially enabled people. As the survey for disability among the adults alone in United States as of 2008 is:

Prevalence of Disability Among Adults, United States 2008

	Disability		No Disability	
	Number of People (in millions)*	Percentage of U.S. Population	Number of People (in millions)*	Percentage of U.S. Population
Total	50.6	22.2	117.2	77.8
Age				
18–44	15.3	13.5	98.2	86.5
45–64	20.8	27.4	55.1	72.6
65+	14.5	37.8	23.9	62.2
Sex				
Male	23.3	21.0	87.7	79.0
Female	27.3	23.4	89.5	76.6

An accessible Web can also help specially enabled people more actively participate in society. Another important consideration for organizations is that Web accessibility is required by laws and policies.

WAI - Web Accessibility Policy Resources links to resources for addressing legal and policy factors within organizations, including a list of relevant laws and policies around the world.

3 Factors in a Business Case for Web Accessibility

The different aspects of the business case for Web accessibility are presented in detail in the following pages:

- Social Factors addresses the role of Web accessibility in providing equal opportunity for specially enabled people; the overlap with digital divide issues; and benefits to people without disabilities, including older people.
- Technical Factors addresses interoperability, quality, reducing site development and maintenance time, reducing server load, enabling content on different configurations and being prepared for advanced web technologies.
- Financial Factors addresses the financial benefits of increased website use, for example, from engine optimization (SEO); direct cost savings; considerations for initial costs and on-going costs; and ways to decrease costs.
- Legal and Policy Factors addresses requirements for Web accessibility from governments and other organizations in the form of laws, policies, regulations, standards, guidelines, directives, communications, orders or other types of documents.

4 Challenges

- Only accessibility supported technologies can be relied upon for accessibility. It further states that the technology is accessibility supported only when user's assistive technology will work with it. Since no list of supported technologies is provided or any formal way to measure if a technology is supported or not, this causes a challenge.
- It is believed that around 80% of the criteria are testable by humans. However, the authors show that some of the description of the techniques for testing causes confusion.
- One challenge is that W3C updates the techniques document for non-proprietary software only. This means that there will be no techniques collected by W3C for proprietary software.
- Following a success technique does not mean that a barrier not exists.
- AJAX – Asynchronous JavaScript and XML is increasingly becoming a vital technology for web design , user Friendly but it makes the screen reader to reset and starts all over again.
- RIA – Rich Internet application like flash, shockwave that rely heavily on graphics, animation and colors makes nightmare for accessibility.
- Extensive colors are used in web application; sometimes colors are used to announce special information and even to require user interaction.
- High band width and faster networks.

5 Risks

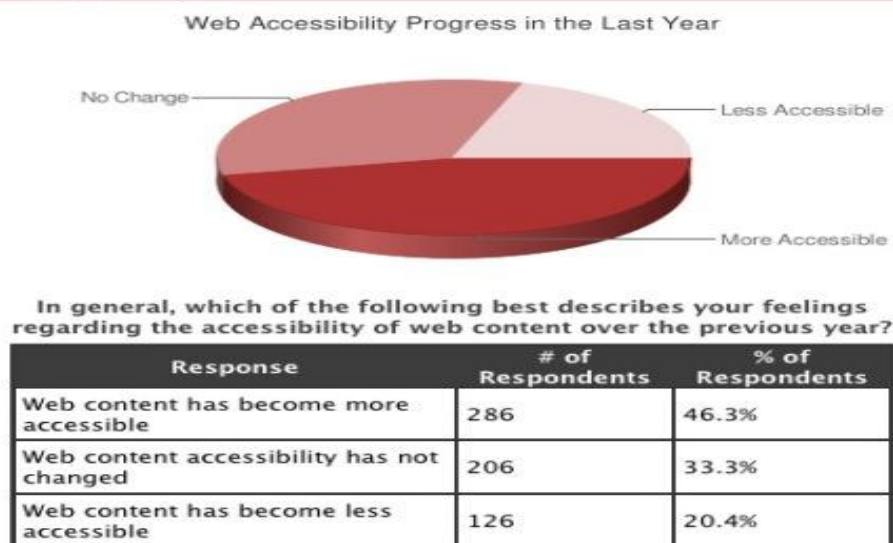
- The role of the web developer to know web accessibility and develop coding feasibly
- Web developers and QA testers themselves tend to know little about accessibility and should have a twofold knowing each other's role
- Accessibility testing can be rigorous not only because specialized knowledge but also with specialized tools
- Testing is further complicated by the difficulty of yielding definitive results
- Validation tools can be validated against a certain standard and will either pass or fail
- Obligation to understand the different types of accessibility issues

6 Progress

So as the Web roars forward with HTML5 standards being debated and more and more advances there is a reason beside just fairness that should make businesses stand up and take notice of web accessibility concerns.

The chart below gives a general idea about how people see the progress being made.

Web Accessibility Progress



7 Web Accessibility Evaluation

Web accessibility testing can be evaluated in three different methods and are follows:

Human:

- Testing performed by an actual person.
- Quality of results depends on knowledge and experience of tester.

Computer:

- Often very fast and efficient.
- Can run completely automated.
- Not everything can be computationally tested! Some things require human evaluation.

Computer-Aided:

- Individual assisted by a computer process.

8 Web Accessibility Evaluation Tools

Web accessibility evaluation tools are software programs or online services that *help* determine if a website meets accessibility guidelines.

Web accessibility evaluation tools can significantly reduce the time and effort to evaluate websites and also determine the conformance of websites to accessibility checks which can be executed automatically and effectively assist reviewers in performing accessibility checks which need to be evaluated manually.

No tool can automatically determine the accessibility of websites. They can only *assist* in doing so, for the following reasons:

Many accessibility checks require human judgment and must be evaluated manually.

Evaluation tools are prone to producing false or misleading results. Hence Indium additionally validates the application source code.

Operated by inexperienced evaluators who don't have the capabilities and are not aware about the limitations of these tools.

8.1 Types of Tools

There are many different types of evaluation tools that can be used to determine whether or not web content is accessible. Here we have analyzed few open source tools necessary for accessibility testing as mentioned below:

- WAVE
- WAT
- JAWS
- Web Developers
- Total Validator
- Color Identifier
- A designer

Comparison of Tools with the Support of Accessibility guidelines and the submission method of the websites.

Sno	Tool	Source	Website submission Method			Accessibility Guidelines referred		
			Manual	URL	File	WCAG1.0	Wcag2.0	Section 508
1	WAVE		Y	Y	Y	Y		Y
2	Adesigner		Y	Y	Y	Y	Y	Y
3	Web Accessibility Inspector			Y	Y	Y		
4	color doctor		Y			Y	Y	Y
5	WAT		Y				Y	Y
6	TotalValidatorBasic			Y	Y	Y	Y	Y
7	Adesigner			Y		Y	Y	Y
8	Eval access	Online		Y		Y		
9	Functional accessibility evaluator	Online		Y		Y	Y	Y
10	TAW	Online		Y	Y	Y	Y	Y
11	Web accessibility checker	Online		Y	Y			
12	Image analyser	Online				Y	Y	Y
13	Hera	Online		Y		Y		
14	Accessibility Vallet	Online		Y		Y	Y	Y

8.2 Disadvantages of Evaluation tools

Automated accessibility checking tools cannot make firm judgments about the accessibility of everything on your page. For example, a tool can tell you if ALT text is missing entirely, but it cannot tell you if the ALT text that is present is clear and useful. That is up to you to judge. Similarly, if the tool detects the use of color, it may remind you to double-check that color are not necessary to understand the page, but because the tool itself cannot "understand" your page, you must check for this manually and decide if you pass the test.

Simulation tools can help you in some of the areas that accessibility testing tools leave to your judgment. For example, viewing your page in a text-browser simulation might help you decide if your ALT text is of good quality, and a color-blindness simulator might help you check if your page depends too much on color. Since simulation tools allow you to see potential problems directly, they are often the best tools for beginners to start with for page testing.

Since web accessibility testing depends so much on the web author's own judgment, be suspicious if a page testing tool tells you that your page meets a standard such as "W3C/WAI AA" unless you have performed all of the manual checks and are confident that you have satisfied those requirements in addition to having passed the automated checks.

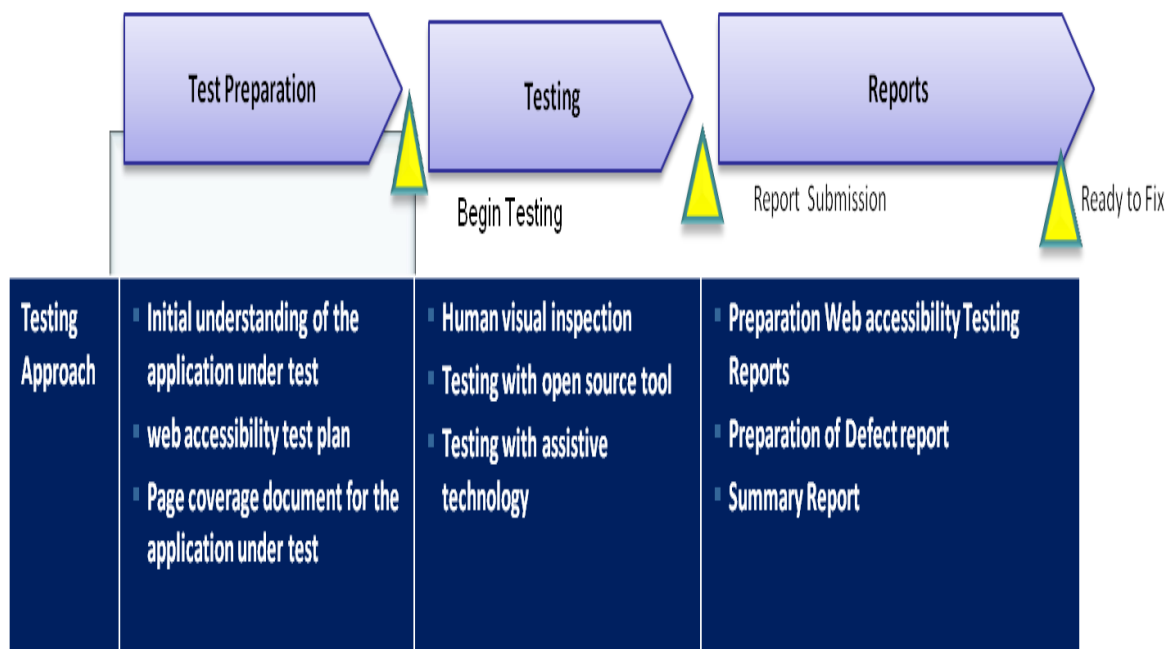
9 Web Accessibility Testing Approach

The web accessibility testing area is still evolving, more and more sponsors are getting awareness about the web accessibility testing. The importance and requirement of web accessibility testing is increasing rapidly. Everybody want to incorporated web accessibility testing but only few know about the approach and only few ready to invest and buy commercial tool to identify the defects .

Because of unavailability, many tend to put the web accessibility testing in pipeline, sometime it's sadly ignored.

So I have introduced a new approach for web accessibility testing, this approach is cost effective and easy to follow.

The Flow chart for the approach and their respective content explanations are follows .



9.1 Test Preparation

9.1.1 Initial Evaluation of the Product

The initial evaluation of the product is very important to frame the applicable accessibility guidelines, so the tester who is going to involve in the project must analyze the application under test. Understanding the entire application functionality and flow is not required, but the tester must know how many pages the application has, because if the user is unable to use any single page, still the application is considered to be not accessible.

The Key points are:

1. The navigation and cover all the pages
2. The purpose of the page & available fields
3. And also if the application or web page requires special software to view the information and how much the user is going to miss if user don't have the software?
4. Check for Frames animations and any visual objects
5. Identify the Guidelines

Accessibility guidelines are many in numbers, but it's not mandatory for the tester to check each and every guidelines. After analyzing the application under test, the tester can frame the applicable accessibility guidelines check list. Creating the checklist will definitely going to save your testing time. It will make testing easier.

The tester should be keen while exploring the application and if the tester finds the guidelines is applicable for the page, tester need to make a note of the guidelines.

In our approach we are testing the application by page wise, so framing the guidelines while exploring will reduce the room for error.

9.1.1.1 Identify the Complexity of the Page

The Tester cannot expect all the pages in the application are simple; you might get some pages that are really hard diagnosed. So the tester might require more and time and tools to identify the issues.

In this approach we have introduced a section to identify the complex pages and investing more time and tools to identify the issues. By this way we are eradicating the accessibility issues in greater extend.

For example: the web page with script oriented or multimedia contents, moving objects, animations, flashes, etc.

9.1.1.2 Identify the Evaluation Tool

There are plenty of accessibility evaluation tools available in markets, but choosing the right tool for the applicable guidelines is considered to be vital role in accessibility testing.

Tester need to identify the accessibility evaluation tool with respect to applicable guidelines.

Later part of this paper reveals the list of tools that are suitable for accessibility testing.

9.1.1.3 Preparation of Page Coverage

There is no need for a web accessibility tester to understand the functionality of each and every object. Since the web accessibility tester is going to evaluate the page & not the functionality of the application, if the application under test is big and robust practically it's not possible for the tester to know all the pages. So the tester can work closely with developers or right people and they can design a page coverage document.

By keeping this document on hand before starting the testing process, will improve the accuracy of your testing and drastically save your time.

9.1.1.4 Web accessibility Check List

After evaluation of the product the tester can prepare the web accessibility check list. So that he can test all the pages against this checklist. By doing this decreases the time consumption of the testing

Here showcased a sample check list

Accessibility Testing Checklist						
S No	WCAG 2.0	Parameter	Section 508	Steps to Reproduce	Status	Failure Description
1.1.1	Perceivable	Text Alternatives	1194.22 (a)			
1.1.2	Perceivable	Controls Input	1194.22 (n)			
1.3.1	Adaptable	Info and Relationships	1194.22 (g) 1194.22 (h) 1194.22 (l)			
1.3.2	Adaptable	Meaningful Sequence	1194.22 (d)			
1.4.1	Perceivable	Use of Color	1194.22 (c)			
1.4.3	Perceivable	Contrast (Minimum)				
2.1.1	Operable	Keyboard				
2.1.2	Operable	No Keyboard Trap				
2.4.1	Operable	ByPass Blocks				
2.4.2	Operable	Page Titled	1194.22 (j)			
2.4.3	Navigable	Focus Order				
2.4.4	Operable	Link Purpose (In Context)	1194.22 (e) 1194.22 (f)			
2.4.6	Navigable	Headings and Labels				
2.4.7	Navigable	Focus Visible				
3.2.1	Understandable	On Focus				
3.2.2	Understandable	On Input				
3.2.3	Understandable	Consistent Navigation				
3.2.4	Understandable	Consistent Identification				
3.3.1	Understandable	Error Identification				
3.3.2	Understandable	Labels or Instructions				
3.3.3	Understandable	Error Suggestion				

9.1.2 Project Plan

Very good planning is half done.

So having project plan is good for any tester to accomplish the task . Some of them are Time duration, Number of resources.

9.1.2.1 Time Duration

The tester can schedule a time frame for the application based on the page coverage, applicable guidelines and Evaluation tools.

9.1.2.2 Number of Resources

The resource for the application is purely depends upon the complexity of the application and volume of the application.

9.1.3 Testing with Evaluation tools

Having said there are plenty of evaluation tools available, the evaluation tool commonly works in three ways

The tool can detect by following ways

1. Using application URL
2. By using source file
3. Add on

Using evaluation tools the tester can identify the defect. In our approach, I have introduced a new concept to improve the accuracy by testing the application with combination of tools so tester need to check with multiple evaluation tools in order to increase the accuracy of the particular page.

Here mentioned few tools that are recommended for web accessibility testing, the happy news is all are open source tools:

S.no	Open Source Tools	Manual	Url	File	WCAG 1.0	WCAG 2.0	Section 508
1	Wave	Yes	NR	No	Yes	A,AA	Yes
2	WAT	Yes	NA	No	Yes	A,AA	Yes
3	A Designer	Yes	NR	No	Yes	Yes	Yes
4	Color doctor	Yes	Yes	No	Color Guidelines	Color Guidelines	Color Guidelines
5	Total validator	No	Yes	Yes	HTML ,CSS	HTML ,CSS	HTML ,CSS
6	Web accessibility checker	No	Yes	Yes	Frames, Flicker	Frame, Flicker	Frame, Flicker
7	Functional accessibility evaluator	Yes	Yes	Yes	Scripting	Navigation & orientation	Navigation & orientation

9.1.4 Visual Inspection

The interesting part in web accessibility testing is: no tool can automatically determine the accessibility of Web sites. Whether it's commercial or open source.

So visual inspection is needed for few guidelines to determine the compliance factor. The accessibility & guidelines knowledge are highly required at this stage.

9.1.5 Testing with Assistive Technology

Web accessibility testing require one more step to accomplice its task, its none other than Assistive Technology testing.

Assistive technology is technology used by differently abled people in order to perform functions that might otherwise be difficult or impossible.

By testing the application against the assistive technology the tester can find out the accessibility barriers faced by special users.

Examples are:

Screen reader software, Braille terminals, Screen magnification software, and Speech recognition software.

9.2 Reports

A project is always incomplete without matrices, so generating report from the approach is final step in our approach that gives a good shape for our approach

9.2.1 Analyzing the Testing Approach

The tester the can combine the evaluation tools report, visual inspection report and Assistive technology report and check for the valid defects.

9.2.2 Preparation of Defect Report

Based on the analyzed report, tester can sort out the defect report for the application in an effective manner.

This will be helpful for the developer to understand the issues and fix defects efficiently.

9.2.3 Summary Report

Summary report can be categorized into two ways:

9.2.3.1 Page Wise Metrics

Will give you the pass and fail criteria with respect to the page

Sample:

TESTING APPROACH FOR WEB ACCESSIBILITY 2015

Accessibility Page Wise - Metrics								
S.No	Page Title	Pass	Fail	N/A	No: Of Guidelines	Pass %	Fail %	N/A%
1	Page 1							
2	Page 2							
3	Page 3							
4	Page 4							
5	Page 5							
6	Page 6							
7	Page 7							
8	Page 8							
9	Page 9							
10	Page 10							

9.2.3.2 Guidelines wise Metrics

Will give you the Pass and Fail criteria with respect to the guidelines

Sample:

Accessibility Guidelines Wise - Metrics						
WCAG 2.0	Guideline	Section 508	Pass	Fails	N/A	% Implementation
1.1.1	Text Alternatives	1194.22 (a)				
1.1.2	Controls Input	1194.22 (n)				
1.3.1	Info and Relationships	1194.22 (g) 1194.22 (h) 1194.22 (l)				
1.3.2	Meaningful Sequence	1194.22 (d)				
1.4.1	Distinguishable	1194.22 (c)				
1.4.3	Distinguishable					
2.1.1	Keyboard Accessible					
2.1.2	Keyboard Accessible					
2.4.1	Navigable					
2.4.2	Navigable	1194.22 (j)				
2.4.3	Focus Order					
2.4.4	Navigable	1194.22 (e) 1194.22 (f)				
2.4.6	Headings and Labels					
2.4.7	Focus Visible					
3.2.1	On Focus					
3.2.2	On Input					
3.2.3	Predictable					
3.2.4	Predictable					
3.3.1	Input Assistance					
3.3.2	Input Assistance					
3.3.3	Input Assistance					
Assistive Technology	Screen Reader					

9.2.4 VPAT

After completing the Web accessibility testing VPAT can be prepared for the application to limelight the Compliance factors involved in the Website.

This VPAT is going to act as a visiting card for the procurement team.

Sample:

Section 1194.22 Web-based Internet information and applications – Detail		
VPAT		
Voluntary Product Accessibility Template		
Criteria	Supporting Features	Remarks and explanations
(a) A text equivalent for every non-text element shall be provided (e.g., via "alt", "longdesc", or in element content).		
(b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.		
(c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.		
(d) Documents shall be organized so they are readable without requiring an associated style sheet.		
(e) Redundant text links shall be provided for each active region of a server-side image map.		

10 Conclusion

The web offers so many opportunities to specially enabled people that are unavailable through any other medium. It offers independence and freedom. However, if a web site is not created with web accessibility in mind, it may exclude a segment of the population that stands to gain the most from the internet. Most people do not intend to exclude specially enabled people. As organizations and designers become aware of and implement accessibility, they will ensure that their content can be accessed by a broader population. We've learned how important it is for an organization to set accessibility standards and by that how accessibility can build a good business case for integrating accessibility into an organization's web development processes in cost effective manner.

About Indium Software

At Indium Software, we've been entrenched in the world of software testing since 1999. We've built a team of 450+ software and test professionals in our offices in Chennai, Bengaluru, New Jersey, Sunnyvale, London and Kuala Lumpur.

The core of Indium's objective to servicing our global customers can be explained with this simple line: "We're small enough to care, large enough to deliver." We are a preferred testing vendor for enterprise and ISV customers ranging from Fortune 100 to 5000 companies and small to medium enterprises.

Till date, we've served over 250 clients in the U.S., and Rest of the World.

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