Accessible Web Mapping Apps

Kelly Hutchins
Tao Zhang
What is accessibility?

• Make content usable by as many people as possible
• About 15% of world population lives with some form of disability: 1 billion people
• In the US, 1 in 5 adults has a disability
• Disabilities could be temporary or situational
Why is accessibility important?

- People with disabilities deserve equal rights
- The ADA and Section 508
- Accessible interface is about good design and coding practice
- Good accessibility is good user experience
What are we doing?

- Better knowledge sharing
- Review products internally for compliance
- Working accessibility into new features
Web Content Accessibility Guidelines

WCAG
Web Content Accessibility Guidelines (WCAG) 2.0
W3C Recommendation 11 December 2008

This version:
http://www.w3.org/TR/2008/REC-WCAG20-20081211/

Latest version:
http://www.w3.org/TR/WCAG20/

Previous version:
http://www.w3.org/TR/2006/REC-WCAG20-20061106/

Editors:
Ben Caldwell, Trace R&D Center, University of Wisconsin-Madison
Michael Cooper, W3C
Loretta Guarino Reed, Google, Inc.
Gregg Vanderheiden, Trace R&D Center, University of Wisconsin-Madison

Previous Editors:
Wendy Chinnick (until July 2008 while at W3C)
John Batlin (until June 2008 while at Accessibility Institute, University of Texas at Austin)
Jason White (until June 2008 while at University of Melbourne)

Please refer to the errata for this document, which may include normative corrections.

See also translations.

This document is also available in non-English languages, available from Alternate Versions of Web Content Accessibility Guidelines 2.0.

Copyright © 2008 W3C® (MIT/ERCIM Web). All Rights Reserved. W3C liability, trademark and document use rules apply.

Abstract

Web Content Accessibility Guidelines (WCAG) 2.0 covers a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these. Following these guidelines will also make your Web content more usable to users in general.

WCAG 2.0 success criteria are written as testable statements that are not technology-specific. Guidance about satisfying the success criteria in specific technologies, as well as general information about interpreting the success criteria, is provided in separate documents. See Web Content Accessibility Guidelines (WCAG) Overview for an introduction and links to WCAG technical and educational material.

WCAG 2.0 succeeds Web Content Accessibility Guidelines 1.0 (WCAG10), which was published as a W3C Recommendation May 1999. Although it is possible to conform either to WCAG 2.0 or to WCAG 1.0 (or both), the W3C recommends that new and updated content use WCAG 2.0. The W3C also recommends that Web accessibility policies reference WCAG 2.0.

Status of this Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current W3C publications and the latest revision of this technical report can be found in the W3C technical reports index at http://www.w3.org/TR/.

This is the Web Content Accessibility Guidelines (WCAG) 2.0 W3C Recommendation from the Web Content Accessibility Guidelines Working Group.

Web Content Accessibility Guidelines (WCAG) 2.1
W3C Working Draft 07 December 2017

This version:
https://www.w3.org/TR/2017/WD-WCAG21-20171207/

Latest published version:
https://www.w3.org/TR/WCAG21/

Latest editor's draft:
https://w3c.github.io/wcag21/guidelines/

Previous version:
https://www.w3.org/TR/2017/WD-WCAG21-20170912/

Latest Recommendation:
https://www.w3.org/TR/2017/REC-WCAG21-20171207/

Editors:
Andrew Kirkpatrick, Adobe, akirkpat@adobe.com
Joshua O Conner, Invited Expert, InterAccess, jconner@interaccess.ie
Michael Cooper, W3C, cooper@w3.org

WCAG 2.0 Editors:
Ben Caldwell, Trace R&D Center, University of Wisconsin-Madison
Loretta Guarino Reed, Google, Inc.
Gregg Vanderheiden, Trace R&D Center, University of Wisconsin-Madison
Wendy Chinnick, W3C
John Batlin, Accessibility Institute, University of Texas at Austin
Jason White, University of Melbourne

Copyright © 2017 W3C® (MIT/ERCIM Web). All Rights Reserved. W3C liability, trademark and document use license rules apply.

Abstract

Web Content Accessibility Guidelines (WCAG) 2.1 covers a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity, and combinations of these. These guidelines address accessibility of web content on desktops, laptops, tablets, and mobile devices. Following these guidelines will also make your Web content more usable to users in general.

WCAG 2.1 success criteria are written as testable statements that are not technology-specific. Guidance about satisfying the success criteria in specific technologies, as well as general information about interpreting the success criteria, is provided in separate documents. See Web Content Accessibility Guidelines (WCAG) Overview for an introduction and links to WCAG technical and educational material.

WCAG 2.1 extends Web Content Accessibility Guidelines 2.0 (WCAG20), which was published as a W3C Recommendation December 2008. Content that conforms to WCAG 2.1 also conforms to WCAG 2.0, and therefore to policies that reference WCAG 2.0.
# Overview of WCAG 2.0

<table>
<thead>
<tr>
<th>Principles</th>
<th>Success Criteria</th>
<th>Level A</th>
<th>Level AA</th>
<th>Level AAA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Perceivable</strong></td>
<td>1.1 Text Alternatives</td>
<td>1.1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2 Time-based Media</td>
<td>1.2.1 – 1.2.3</td>
<td>1.2.4 – 1.2.5</td>
<td>1.2.6 – 1.2.9</td>
</tr>
<tr>
<td></td>
<td>1.3 Adaptable</td>
<td>1.3.1 – 1.3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.4 Distinguishable</td>
<td>1.4.1 – 1.4.2</td>
<td>1.4.3 – 1.4.5</td>
<td>1.4.6 – 1.4.9</td>
</tr>
<tr>
<td><strong>2. Operable</strong></td>
<td>2.1 Keyboard Accessible</td>
<td>2.1.1 – 2.1.2</td>
<td></td>
<td>2.1.3</td>
</tr>
<tr>
<td></td>
<td>2.2 Enough Time</td>
<td>2.2.1 – 2.2.2</td>
<td></td>
<td>2.2.3 – 2.2.5</td>
</tr>
<tr>
<td></td>
<td>2.3 Seizures</td>
<td>2.3.1</td>
<td></td>
<td>2.3.2</td>
</tr>
<tr>
<td></td>
<td>2.4 Navigable</td>
<td>2.4.1 – 2.4.4</td>
<td>2.4.5 – 2.4.7</td>
<td>2.4.8 – 2.4.10</td>
</tr>
<tr>
<td><strong>3. Understandable</strong></td>
<td>3.1 Readable</td>
<td>3.1.1</td>
<td>3.1.2</td>
<td>3.1.3 – 3.1.6</td>
</tr>
<tr>
<td></td>
<td>3.2 Predictable</td>
<td>3.2.1 – 3.2.2</td>
<td>3.2.3 – 3.2.4</td>
<td>3.2.5</td>
</tr>
<tr>
<td></td>
<td>3.3 Input Assistance</td>
<td>3.3.1 – 3.3.2</td>
<td>3.3.3 – 3.3.4</td>
<td>3.3.5 – 3.3.6</td>
</tr>
<tr>
<td><strong>4. Robust</strong></td>
<td>4.1 Compatible</td>
<td>4.1.1 – 4.1.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What we will cover today

• Focus and keyboard
• Color
• Information and relationships
• Testing
• Accessible map
Focus and keyboard
Focus

- **WCAG 2.4.7**: Any keyboard operable user interface has a mode of operation where the keyboard focus indicator is visible.

- Interactive HTML elements should have clear focus
- Don’t set `outline: 0px` for `:focus`
- For links use `text-decoration: underline` for `:hover` & `:focus`, or make it more decorative
ArcGIS API for JavaScript

Classes with focus method:
- MapView and SceneView
- Popup
- Search

```javascript
view.popup.watch("visible", () => {
    if (view.popup.visible) {
        view.popup.focus();
    } else {
        search.focus();
    }
});
```
Tab order

- **WCAG 1.3.2**: Navigation order, as determined by DOM structure, should be logical and intuitive.

- Be careful changing visual position of elements on screen using CSS
- Avoid jumping around tab order
<table>
<thead>
<tr>
<th><code>tabindex</code></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;0&quot;</td>
<td>Let natural DOM structure determine tab order</td>
</tr>
<tr>
<td>&quot;-1&quot;</td>
<td>If need to programmatically move focus by calling <code>focus()</code></td>
</tr>
<tr>
<td>&quot;4&quot;</td>
<td>Anti-pattern</td>
</tr>
</tbody>
</table>
Keyboard

- **WCAG 2.1.1**: Keyboard users should be able to use all page functionalities using keyboard only.
- Native interactive elements like `<a>`, `<button>`, and `<input>` receive keyboard actions
- Support appropriate keystrokes as if it were native element (e.g., Space & Enter on button)
### Map navigation

<table>
<thead>
<tr>
<th>Action</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow keys</td>
<td>Nudge the view to the left, right, up, or down</td>
</tr>
<tr>
<td>N</td>
<td>Adjust the view to point north</td>
</tr>
<tr>
<td>A</td>
<td>Rotate the view counter clockwise</td>
</tr>
<tr>
<td>D</td>
<td>Rotate the view clockwise</td>
</tr>
<tr>
<td>+</td>
<td>Incrementally zoom in</td>
</tr>
<tr>
<td>-</td>
<td>Incrementally zoom out</td>
</tr>
</tbody>
</table>

### SceneView navigation

<table>
<thead>
<tr>
<th>Action</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow keys</td>
<td>Nudge the scene to the left, right, up, or down</td>
</tr>
<tr>
<td>P</td>
<td>Move the camera to look perpendicular</td>
</tr>
<tr>
<td>N</td>
<td>Adjust the scene to point north</td>
</tr>
<tr>
<td>J</td>
<td>Move down closer to the view</td>
</tr>
<tr>
<td>U</td>
<td>Move up, higher from the view</td>
</tr>
</tbody>
</table>

Keyboard example

```html
<div class="button dark" role="button" tabindex="0" id="buttonId">
    Search
</div>

document.getElementById("buttonId")
    .addEventListener("keyup", function(event) {
        event.preventDefault();
        if((event.keyCode === 13) || (event.keyCode === 32)) {
            // respond to Enter/Space keys;
        }
    });
```
No keyboard trap

- **WCAG 2.1.2**: Content does not “trap” keyboard focus within subsections.
- Keyboard focus stay inside modal dialog until dialog dismissed.
- Restore keyboard focus to previously focused element after dialog dismissed.
Keyboard trap example

Modal Dialog Example

Following is an example implementation of the design pattern for modal dialogs. The below “Add Delivery Address” button opens a modal dialog that contains two buttons that open other dialogs. The accessibility features section explains the rationale for initial focus placement and use of aria-describedby in each dialog.

Example

Add Delivery Address

Accessibility Features

1. To make the content easier to read when displayed on small screens, the dialog fills 100% of the screen. Completely covering the background window also hides background movement that occurs on some mobile devices when scrolling content inside the dialog.

2. Focus and accessible descriptions are set based on the content of each dialog.

1. “Add Delivery Address” dialog (id=dialog1):
   - Initial focus is set on the first input, which is the first focussable element.
   - The dialog does not need aria-describedby since there is no static text that describes it.
   - When the dialog closes as a result of the “Cancel” action, the user’s point of regard is maintained by returning focus to the “Add Delivery Address” button.
   - When the dialog closes as a result of the “Add” action and the “Address Added” dialog replaces the “Add Delivery Address” dialog, the “Add Delivery Address” dialog passes a reference to the “Add Delivery Address” button to the the “Address Added” dialog so that it can maintain the user’s point of regard when it closes.

2. “Verification Result” dialog (id=dialog2):

https://www.w3.org/TR/wai-aria-practices/examples/dialog-modal/dialog.html
Test focus and keyboard

- Tab through page to verify all interactive elements have focus
- Visual focus order matches intended interaction order
- Interact with all controls, links, and menus using only keyboard
- No keyboard trap except for modals
- Off-screen content like responsive navigation should not receive focus when invisible
Color contrast
Use of color

- **WCAG 1.4.1**: Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.
Minimum contrast

- **WCAG 1.4.3**: The visual presentation of text and images of text has a contrast ratio of at least 4.5:1, except for large text (ratio of at least 3:1), incidental text, or logotype.
Test color

- Look for content differentiated by color only
- Run an automated test tool: aXe
- Use a contrast ratio calculator
Info and relationships
Clear semantics

- **WCAG 1.3.1**: Content should have good semantic structure.
- Assistive Technologies (AT) rely on semantic code to drive their behavior.
- Information architecture is important.
- Non-sighted users should be able to infer the same information as sighted users without depending on colors, shape, or typography for context.
Semantics example

- Sighted users see a checkbox as a result of CSS class checkbox.
- AT users will not know this is meant to be a checkbox.

- The checkbox role is used for checkable interactive controls.
- It's also required to have `aria-checked` attribute to expose checkbox state to AT users.
WAI-ARIA

- Specification for increasing accessibility of custom elements.
- Allows developers to modify and augment standard DOM to accessibility tree for AT.

[Link to Google Developers documentation](https://developers.google.com/web/fundamentals/accessibility/semantics-aria/)
# WAI-ARIA Authoring Practices 1.1

W3C Working Group Note 14 December 2017

This version:
https://www.w3.org/TR/2017/NOTE-wai-aria-practices-1.1-20171214/

Latest published version:
https://www.w3.org/TR/wai-aria-practices-1.1/

Latest editor’s draft:
https://w3c.github.io/aria-practices/

Previous version:
https://www.w3.org/TR/2017/WD-wai-aria-practices-1.1-20170628/

Editors:
Matt King, Facebook, mok@fb.com
James Nurthen, Oracle Corporation, james.nurthen@oracle.com
Michiel Bijl, Invited Expert
Michael Cooper, W3C, cooper@w3.org
Joseph Scheuhammer, Inclusive Design Research Centre, OCAD University (Previous Editor)
Lisa Pappas, SAS (Previous Editor)
Rich Schwartzfeger, IBM Corporation (Previous Editor)

Copyright © 2015-2017 W3C® (MIT, ERCIM, Keio, Beihang). W3C liability, trademark and permissive document license rules apply.

## Abstract

This document provides readers with an understanding of how to use WAI-ARIA 1.1 [wai-aria-1.1] to create accessible rich internet applications. It describes considerations that might not be evident to most authors from the WAI-ARIA specification alone and recommends approaches to make widgets, navigation, and behaviors accessible using WAI-ARIA roles, states, and properties. {}This document is directed primarily to Web application developers, but the guidance is also useful for user agent and assistive technology developers.
Bypass blocks

- **WCAG 2.4.1**: Pages should have mechanisms like Skip-Navigation and WAI ARIA landmark roles for users to jump to main content or a particular content area.
Bypass blocks example
Labels or instructions

- **WCAG 3.3.2**: Labels or instructions are provided when content requires user input.
- Labels should be associated with form inputs.
Label examples

Associate label implicitly

```
<label>
  Email
  <input type="text" placeholder="name@example.com">
</label>
```

Associate label explicitly

```
<label for="firstname">First name:</label>
<input type="text" name="firstname" id="firstname">
```

Use aria-label

```
<input type="text" name="search" aria-label="Search">
<button type="submit">Search</button>
```
Live region

- Ask screen reader to announce dynamic changes
- Roles for various contexts

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>log</td>
<td>Chat, error, game or other type of log</td>
</tr>
<tr>
<td>status</td>
<td>A status bar or area of the screen that provides an updated status of some kind. Screen reader users have a special command to read the current status.</td>
</tr>
<tr>
<td>alert</td>
<td>Error or warning message that flashes on the screen. Alerts are particularly important for client side validation notices to users. (TBD: link to ARIA form tutorial with aria info)</td>
</tr>
<tr>
<td>progressbar</td>
<td>A hybrid between a widget and a live region. Use this with aria-valuemin, aria-valuenow and aria-valuemax. (TBD: add more info here).</td>
</tr>
<tr>
<td>marquee</td>
<td>for text which scrolls, such as a stock ticker.</td>
</tr>
<tr>
<td>timer</td>
<td>or any kind of timer or clock, such as a countdown timer or stopwatch readout.</td>
</tr>
</tbody>
</table>
Test info and relationships

- Run automated test
- Use screen reader to tab through page
- Look for Skip-Navigation and landmarks
- Click on label to see if associated form input is focused
- Use screen reader to fill in forms
The process

- Automated test
- Keyboard test
- Screen reader test
aXe

- Tests rendered browser DOM
- Less false positives
- Accessible
- Good documentation
Keyboard navigation

- **Tab** | **Shift** | **Tab**
  - Move keyboard focus
- **Enter**
  - Click links
- **Enter** | **Space**
  - Click buttons

Menus and some form controls
Recommended combinations:

<table>
<thead>
<tr>
<th>OS</th>
<th>Screen reader</th>
<th>Browser</th>
</tr>
</thead>
<tbody>
<tr>
<td>MacOS</td>
<td>VoiceOver</td>
<td>Safari</td>
</tr>
<tr>
<td>Windows</td>
<td>NVDA</td>
<td>Firefox</td>
</tr>
<tr>
<td>Windows</td>
<td>JAWS</td>
<td>IE/Edge</td>
</tr>
<tr>
<td>Screen reader</td>
<td>Turn on</td>
<td>Turn off</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>VoiceOver</td>
<td>Command + F5</td>
<td>Command + F5</td>
</tr>
<tr>
<td>NVDA</td>
<td>Control + Alt + N</td>
<td>NVDA + Q</td>
</tr>
<tr>
<td>JAWS</td>
<td>Control + Alt + J</td>
<td>Insert + F4</td>
</tr>
</tbody>
</table>
VoiceOver commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO + right/left arrow</td>
<td>Read next/previous item</td>
</tr>
<tr>
<td>Control</td>
<td>Stop reading</td>
</tr>
<tr>
<td>VO + space</td>
<td>Click link, button, form controls</td>
</tr>
<tr>
<td>VO + u</td>
<td>Open rotor</td>
</tr>
</tbody>
</table>
Accessible map
A11y map testing

- kellyhutchins update zoom in and out text so its read correctly by screen reader
- css update zoom in and out text so its read correctly by screen reader
- .gitignore Add .gitignore
- CODE_OF_CONDUCT.md Create CODE_OF_CONDUCT.md
- CONTRIBUTING.md Create CONTRIBUTING.md
- LICENSE Updates to set application, update to 4.4 and resolve issues with Chr...
- README.md Update README.md
- index.html update zoom in and out text so its read correctly by screen reader
- package-lock.json Add .gitignore
- package.json Update to add optional directions.
- tsconfig.json Updates to set application, update to 4.4 and resolve issues with Chr...
- typings.d.ts Updates to set application, update to 4.4 and resolve issues with Chr...

Latest commit e81a223 2 days ago

https://github.com/kellyhutchins/a11y-map
Schedule
Hands-on Workshops

Tuesday, March 6
1:00 – 2:00 PM
Introducing UX to your GIS Org
Mesquite B

4:00 – 5:00 PM
DIY Usability Testing
Mesquite C

Thursday, March 8
9:00 – 10:00 AM
DIY Accessibility
Mesquite B

1:00 – 2:00 PM
ArcGIS Runtime: Building Great User Experience
Smoketree A-E

2:30 – 3:30 PM
Collaborative Brainstorming
Mesquite G-H

4:00 – 5:00 PM
Customizing the ArcGIS API for JavaScript Widgets
Primrose A

Friday, March 9
8:30 – 9:30 AM
Accessible Web Mapping Apps

10:00 – 11:00 AM
DIY Usability Testing
Smoketree A-E
Please Take Our Survey!

Download the Esri Events app and find your event

Select the session you attended

Scroll down to the “Feedback” section

Complete Answers, add a Comment, and Select “Submit”