W3C Accessibility Conformance Testing (ACT) Rules for WCAG

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Abstract

The W3C Web Accessibility Initiative (WAI) is currently in the process of formally publishing a first set of Accessibility Conformance Testing (ACT) Rules for the Web Content Accessibility Guidelines (WCAG) 2. These ACT Rules are publicly documented checks for web accessibility, to help improve consistency and transparency among automated testing tools and manual testing methodologies. This paper introduces this work of the W3C Web Accessibility Initiative (WAI) on internationally harmonized ACT Rules.

Structure of ACT Rules

The structure of an ACT Rule is defined by the ACT Rules Format 1.0 specification (Fiers et. al., 2019). ACT Rules consist of the following parts:

- **Descriptive Title** – title for the ACT Rule, such as "Buttons have an accessible name"
- **Rule Identifier** – identifier for the ACT Rule (within a ruleset), such as HTML/Button-1
- **Rule Type** – there are two basic types of ACT Rules, depending on what is being tested:
  - **Atomic Rule** – test one specific situation, which may be part of a composite rule
  - **Composite Rule** – combine outcome from multiple atomic rules to one outcome
- **Accessibility Requirements Mapping** – maps the ACT Rule to particular accessibility requirements, such as Web Content Accessibility Guidelines (WCAG) 2 Success Criteria
- **Rule Input** – describes the scope of input into ACT Rules, which is one of the following:
  - **Input Aspects** – input into atomic rules, such as DOM Tree and CSS Styling etc.
  - **Input Rules** – input into the composite rules, which are the atomic rules in scope
- **Applicability** – description of the specific parts of the content, for which the rule applies
- **Expectations** – description of the expected characteristics of the applicable rule content
- **Assumptions** – assumptions made, such as specific interpretations of the requirements
- **Accessibility Support** – known limitations regarding browsers and assistive technology
- **Test Cases** – sample code demonstrating passed, failed, and inapplicable rule conditions
- **Change Log** – history of changes for the ACT Rules, to support backward compatibility
- **Glossary** – list of key terms defined by the ACT Rule or used by the specific ACT Rule
- **Issues List (Optional)** – list of known issues or bugs for the particular ACT Rule, if any
- **Background (Optional)** – relevant background, such as additional documentation, if any
- **Acknowledgements (Optional)** – such as rule writers, reviewers, and other contributors

Descriptive Title

Every rule needs to have a descriptive title. The specification does constrain the style and format of such titles because different organizations have varying practices. It is, however, a consensus within the W3C ACT Rules Community Group to use 'positive formulation'. For example, titles should read:

> Buttons have an accessible name ✓

Rather than:

> Buttons do not have an accessible name ×

Another convention for writing titles for ACT Rules is to avoid mentioning specific technologies except if the rule is actually confined to particular technologies. For example, the rule above may apply to both HTML and WAI-ARIA, which is why preferably no technology is mentioned.

Rule Identifier

To simplify automated processing of ACT Rules, and especially of results from testing, every rules must have an identifier. An identifier is a short handle. It could be a database reference, a web address (URI), or any such identifier for a rule in a particular context.

The specification does not further constrain the format of identifiers because there can be many different contexts within organizations and testing tools. Yet one requirement is that identifiers must be unique within a set (logical collection) of ACT Rules. For example, if an organization publishes a ruleset, each rule within that set must have a uniquely distinct identifier.

Rule Type

Essentially, there are two types of ACT Rules:

- **Atomic Rule** – test one specific situation, which may be part of a composite rule
- **Composite Rule** – combine outcome from multiple atomic rules to one outcome

The underlying intention is to encourage rule authors to break down complex checks into smaller sub-checks (atomic rules), which are combined together in a transparent way (composite rules).

Atomic Rules

Atomic rules test for one specific situation, such as if page components identified as buttons have an accessible name. Many accessibility checks can be formulated using atomic rules. However, some accessibility requirements have 'or'-conditions or exceptions, and cannot be formulated in simple atomic rules. For example, WCAG Success Criterion 2.1.2 requires that navigation on a web page can be carried out with standard keys or that the user is informed about the keys they need to use for navigation, to avoid 'keyboard traps'. This requires that each condition, 'standard keys' and 'user informed' to be formulated in separate atomic rules, and to formulate the overall check in a third composite rule that utilizes these two atomic rules.

Composite Rule

Composite rules do not reflect actual checks as atomic rules do. Instead, they combine the results from a set of atomic rules in a particular logic to reflect a higher-level accessibility check. These combinations could be more complex than the previously described check for 'keyboard traps'. For example, a rule that checks if pre-recorded video has accessible alternatives (WCAG Success Criterion 1.2.1) checks several aspects using atomic rules, of which at least one needs to be true:

- The video is not an alternative for other content
- The video has an audio description track
- The video has a transcript accompanying it
- The video is accompanied by another alternative

The specification does not allow the cascading of rules in further levels, such as composite rules within other rules. Such cascades would potentially start reflecting tool-specific architectures for checking rather than to remain agnostic to specific tools and methodologies.

Accessibility Requirements Mapping

Each rule must describe how it relates to specific accessibility requirements, such as to WCAG. The ACT Rules Format 1.0 specification has been designed to address WCAG testing but is not limited to WCAG. For example, the specification can be used to write rules for other standards, such as company-internal guidelines, contractual obligations, and local policies that may define particular accessibility requirements. This also allows the specification to address future versions of WCAG being explored in the W3C Accessibility Guidelines Working Group (AGWG).

In some cases, when atomic rules are designed for used within composite rules, they may not be checking for any particular accessibility requirement. For example, checking for 'standard keys' and 'user informed' (as described above) are in themselves no accessibility checks. Only when these are combined to check for 'keyboard traps', does the composite rule check accessibility.

When an ACT Rule maps to an accessibility requirement and the outcome of running that rule on a piece of content is 'failed', then it **must** mean that this content does not meet the accessibility requirement. However, for the outcome is 'pass' the ACT Rule must define if that means that the content meets the accessibility requirement or whether further testing is needed to determine that.

Rule Input

Rule input describes what the rule consumes to calculate an outcome. This is different for atomic rules that operate directly on the content and for composite rules that operate on other rules.

Input Aspects

For atomic rules, the 'input' could by roughly described as the type of content that the rule is run on. For example, this could be the Hyper-Text Markup Language (HTML), the Cascading Style Sheets (CSS), the Document Object Model (DOM), or combinations of these and other content technologies. Rules must only process content from the specified input aspects.

Input Rules

For composite rules, the ‘input’ are the atomic rules that are used to calculate an outcome. More specifically, the ‘input’ is actually the ‘outcome’ from running every specified input on the same ‘test subject’. These outcome results are then combined according to a logic specified in the rule, to calculate an overall ‘outcome’ for the composite rule itself.

Applicability

The applicability is, together with the expectations, the heart piece of ACT Rules. Applicability defines the exact parts of the content that apply to the rule. For example, for the above mentioned ACT Rule “Buttons have an accessible name”, the term ‘button’ is ambiguous as it is defined by both HTML and CSS. To address this issue, the applicability section for this rule reads:

> The rule applies to elements that are included in the accessibility tree with the semantic role of `button`, except for `input` elements of `type="image"`.

In this, exact definitions for ‘included in the accessibility tree’ and ‘sematic role’ are linked from the description to avoid ambiguity. Such a specific definition for the applicability allows readers to better understand what the rule is specifically testing and what it is not, to ensure transparency.

Expectations

Similar to applicability, also expectations can be ambiguous if they are not described in more detail. Continuing with the above-mentioned ACT Rule “Buttons have an accessible name”, also the phrase ‘have an accessible name’ is ambiguous if it is not described more specifically.

The expectations section for this rule therefore reads:

> Each target element has an accessible name that is not only whitespace.

The term ‘target element’ refers to the selection defined by the applicability section. Definitions are provided for the terms ‘accessible name’ and ‘whitespaces’, to avoid ambiguity of the phrase.

When the expectations is met for every target element, the outcome of the rule is ‘passed’. If the expectations is not met for any target element, the outcome of the rule is ‘failed’. If there are no target elements, then the outcome of the rule is ‘not applicable’.

Assumptions

In some cases, assumptions need to be made, in which case they must be adequately documented for transparency. For example, for the above mentioned ACT Rule “Buttons have an accessible name”, an assumption is made that ‘buttons’ are considered ‘user interface components’:

> The rule assumes that all buttons are user interface components as defined by WCAG 2.

This is because WCAG does not actually state that buttons must have accessible names. It does, however, state that all user interface components must have a defined ‘role’, ‘name’, and ‘value’. Only under the assumption that buttons are user interface components would they then need to

have a ‘name’. In some cases this may seem as stating the obvious but many differences in web accessibility testing occur from different assumptions being made without proper documentation.

Accessibility Support

Also, part of proper documentation is to record any known accessibility support aspects related to the rule. For example, technically using the ‘title’ attribute is one way of providing an accessible name to a user interface component, such as to a form field. Given how the ACT Rule is written, the calculation for accessible name will pass content using this technique to identify form fields. However, some assistive technologies do not (correctly) process the ‘title’ attribute so that this technique is actually not suitable for them. This section is to record such caveats of a rule.

Test Cases

One of the most practical sections of an ACT Rule is its test cases. These include examples of:

- Code that is expected to produce ‘passed’ outcome
- Code that is expected to produce ‘failed’ outcome
- Code that is expected to produce ‘not applicable’ outcome

This has three primary purposes:

1. Help the rule author write accurate rules (test-driven authoring)
2. Help the reader understand what the rule does in practical terms
3. Help implementers of the rule to validate their implementations

While the ACT Rules Format 1.0 specification does not define any specific requirements for how many test case a rule must have, it is generally understood that the more (unique) test cases there are, the better it will be for quality assurance of the rule itself as well as for any implementations.

The ACT Rules Community Group provides a test runner that outputs a JSON file with all test cases, to help implementers run their tools and methodologies against these test cases.

Change Log

Another important aspect of quality assurance is versioning each rule, and documenting changes from one version to another. The changelog section of an ACT Rule captures these changes that were made during the lifetime of the rule.

Glossary

All key terms and phrases used in an ACT Rule must be defined in the glossary. Sometimes they are specific to the particular rule, and sometimes they are used across several rules. For example, the definition for ‘whitespace’ is used multiple times across different rules. Where possible, ACT Rules should refer to existing definitions, such as for ‘user interface components’ that is defined by WCAG or for ‘semantic role’ that is defined by WAI-ARIA.

Issues List (Optional)

Despite best efforts, issues can always occur. These could be minor typos, broken links, or more substantive issues. Such identified issues can be logged in the issues list, for example while the rule is being revised to address issues. That is, ideally all issues will eventually be moved to the changelog section, assuming that the rule is being actively maintained.

Background (Optional)

Often rules relate to existing documentation, such as entries in the Techniques for WCAG 2 or in the Understanding WCAG 2 documentation. They could also relate to references on accessibility support or other materials to help readers and implementers better understand the background of the rule, the intent, and rationale for taking certain decisions.

Acknowledgements (Optional)

Finally, ACT Rules also have a section to credit relevant contributors. This could be a funding entity, such as the European Commission (EC) that has massively contributed to this first set of ACT Rules, relevant organizations and donors, and individuals if needed. This section could also be used to define certain licensing or terms of use for ACT Rules entities own or contribute.

Creation of ACT Rules

Based on ACT Rules Format 1.0 specification (Fiers et. al., 2019) different entities can document ACT Rules. The W3C consensus process is used to review rules proposed from different sources and gather broader support and acceptance of the proposed rules within the community. Formally published ACT Rules are then implemented into the different automated testing tools and manual testing methodologies. Ultimately, this leads to consistent test results and transparent evaluation.

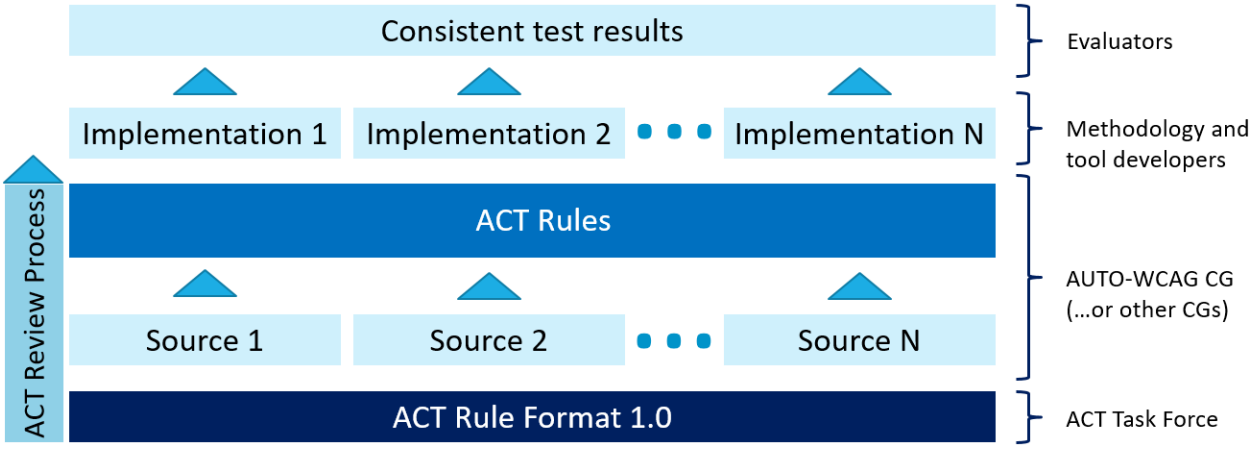

Figure 1: Components of Accessibility Conformance Testing (ACT)

Status of ACT Rules

Currently, ACT Rules are mainly developed by the W3C ACT Rules Community Group (W3C ACT-R CG, 2019). The work is carried out openly on the GitHub development platform:

https://act-rules.github.io/

Anyone can participate in and contribute to this effort. Currently, 56 participants from different organizations and businesses are involved in this work. New participants are joining this effort as we transition from the formerly Auto-WCAG Community Group to this newly branded group.

To date, this group published 47 rules with several more in the development pipeline. These 47 rules were each reviewed by at least three independent reviewers, implemented in at least two automated testing tools or manual testing methodologies, and validated on a set of real websites. That is, they are considered fairly mature and stable, and ready to be submitted to the W3C/WAI Accessibility Guidelines Working Group (W3C AGWG, 2019), which is the group that publishes WCAG and is the authoritative body to interpret WCAG. ACT Rules approved and published by AGWG are expected to become authoritative references for developers of testing tools and methodologies, similarly to how Techniques for WCAG 2 and Understanding WCAG 2 support developers of web content in understanding and implementing the accessibility requirements.

The expectation of the ACT Rules Community Group is to publish a set of 55 rules by October 31st 2019, and to submit a first subset of rules to AGWG for formal W3C publication. Currently the ACT Rules Community Group has active participation from at least 5 automated testing tool developers, at least 4 manual methodology developers, and at least 3 corporations with internal design and testing guidelines. As the group continues to publish rules and succeeds in achieving formally published ACT Rules by AGWG, we expect this participation to continue to increase.

Conclusion

The W3C work on Accessibility Conformance Testing (ACT) was launched in 2016. It is based on prior work dating back to 2001. However, this recent work includes active involvement from commercial tool vendors and from public bodies who were not as involved in prior work. The work can be considered in three complementary aspects:

1. W3C standard to define how ACT Rules are written, to allow different organizations to share their own rules. This standard is expected to be completed in October 2019.
2. W3C community group that is open to anyone, regardless of W3C membership status, to support organization in sharing, reviewing, and agreeing on a common set of rules.
3. A controlled process through which this community group and other organizations can submit candidate rules to the W3C working group for formal recognition and publication.

This work is progressing well. The standard has been maturing according to plan and is now in the final stages of the W3C standardization process. Also an increasing set of candidate rules has been developed by the ACT Rules Community Group, and an initial subset of these rules is currently being submitted to W3C to test-drive and to refine the publication process. Part of this process is to demonstrate a minimal set of at least three independent implementations of the rules before they are published. That is, these rules are not merely theory but being actually adopted by different

tool vendors. We continue to expect that the ACT Rules Format 1.0 standard and an initial set of rules, including the corresponding implementations, by October 2019.

Acknowledgements

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