EuroCloud

Whitepaper

Cloud Computing Guide

Barrier-Free Cloud

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Credits

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1 Preface

Dear Reader,

The UN Convention on the Rights of Persons with Disabilities came into force in 2008. Countries that have ratified this Convention are required to ensure that disabled people have barrier- free access to information processing systems.

Ten percent of Germany's population lives with a recognised physical impairment. The Internet would make it far easier for these people in particular to participate in social, cultural, and professional activities on their own terms. However, a great many websites and cloud applications are not barrier-free. Ironically, those who would benefit most from the possibilities of the cloud are the ones who can only use it with considerable difficulty, or not at all.

Disabled people are adversely confronted by objects, places, programming, and even the attitudes of other people every day – all essentially acting as barriers in their daily lives. As an extension of this, there are the attitudes of cloud service manufacturers. They often lack an awareness of the problem or the ability to create applications that can be used by all people.

People with disabilities are often instructed to use special technical aids in order to be able to operate a website and understand its content. It is not extremely difficult to program cloud applications in such a way that these tools function properly. It should be a self-evident part of the requirements catalogue that underlies any programming task.

EuroCloud wants to promote knowledge, attention, and understanding for barrier-free work in the IT world of the 21st

century. Hence, we have created this guide, which has been translated into a number of languages. EuroCloud would like to extend special thanks to Mr. Mario Batusic, the author of this guide. Blind himself, Mr Batusic is an expert in the field of web and software accessibility and has been able to draw upon his personal experience and considerable knowledge to produce this insightful guide.

Vienna, June 2014

Dr. Tobias Höllwarth
Vice President EuroCloud Europe

2 Introduction

Nobody could have guessed that, when Tim Berners-Lee demanded universal and barrier-free access to the Web for disabled people back in the 1990s, the World Wide Web would evolve from an information hub to a comprehensive software platform. Barriers in cloud services discriminate persons with special needs and also result in immense economic loss.

> "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."
> — Tim Berners-Lee

This guide addresses cloud decision-makers and developers, as well as, those responsible for purchasing IT solutions for organisations and their users.

We will briefly summarise the way individual groups of disabled people interact with information and communication technologies (ICT) and point out key problem areas after providing a general explanation of what 'barrier free' means and why cloud services need to adopt this concept.

This is followed by concrete discussions of how the software development process can incorporate the barrier-free concept, as well as technical aspects of implementing barrier-free Web applications. The 'Organisational Measures' section primarily addresses product and project managers. The 'Technical Measures' section presents the same topic from a developer's perspective.

This guide does not offer comprehensive instructions for implementing barrier-free software. Our goal is rather to create awareness and understanding for this issue and point out relevant laws, technical standards, and guidelines. It is our belief that barrier-free cloud services are as important as other essential characteristics including availability, data security, secure authentication, and the like.

3 Why We Need a Barrier-Free Cloud

Advancement in the private and business sphere strongly relies on information and communication technology (ICT) in the present day and age – and therefore, a barrier in the Web has very much the same impact as a physical barrier. If a person dependent on a wheelchair is unable to access a public building because there is no suitable elevator in place, this creates the same kind of barrier as is imposed by the lack of accessibility that would allow a person with low vision to utilise the website/Web application of the same public office to perform his or her business online. In effect, these barriers prevent persons with a disability from participating in our society in an equal, independent manner.

3.1 Humanitarian and Social Reasons for a Barrier-Free World

The dignity and special needs of disabled people has been recognized formally in 2006 when the '*UN Convention on the Rights of Persons with Disabilities*'[1] of the United Nations (UN) was drafted. It states that society has the general responsibility to remove barriers and create an environment that provides this circle of persons with an equal opportunity.

Article 9 of the UN convention is dedicated to a barrier-free environment. This specifically includes the demand for barrier-free ICT systems. The requirement also applies to cloud services, which represent the most recent form of this technology.

3.2 Legal Situation in Europe

The majority of cloud services is implemented as Web applications and are thus accessed via the Internet or an intranet. Therefore, they are subject to the legal provisions for websites and Web applications. Most EU countries have laws that govern barrier-free accessibility of the Web. All of these laws were passed following numerous EU initiatives and the associated binding

results documents[2]. The key provision is that all public information and services offered by public administrations and their supplying organisations must be free of barriers. The European Standard on '*Accessibility requirements suitable for public procurement of ICT products and services in Europe*'[3] (EN 301 549) published in February 2014 implements this requirement. In brief this document defines requirements for barrier-free ICT purchases performed by or on behalf of public administrations. This means that all websites, Web applications, software and hardware products procured for the public sector must be barrier free. Naturally, the standard could also be applied to the private sector. The next step involves turning this standard into EU law, with corresponding legislation in all member countries.

» EU member countries are obligated to fight any discrimination against persons with disabilities according to the ratification of the '*UN Convention on the Rights of Persons with Disabilities*.'

The demand for barrier-free access is not limited to the public sphere. EU member countries are obligated to fight any discrimination against persons with disabilities according to the ratification of the '*UN Convention on the Rights of Persons with Disabilities*.' These persons are entitled to an equal opportunity in education, employment, business and their private lives. The cloud offering extends to all of these areas, so providers must design barrier-free services or face the risk of being charged with acting in a discriminatory manner. If the legal situation in Europe regarding discrimination continues to progress as it has up to date, there will soon be concrete laws for barrier-free ICT that will not be restricted to the public sector.

The national laws of the member countries are not based on the same standards and guidelines, which presents any international company with a vast challenge.

3.3 Economic Arguments in Favour of Barrier-Free ICT

The best argument for creating barrier-free cloud services is the vast number of EU citizens with disabilities (approx. 90 million people), apart from any legal provisions in place. This number is certain to rise further due to aging populations. Given this backdrop, what type of company can afford to lose 15 to 25% of their potential customers?

» 90 million EU citizens with disabilities

The '*OneVoice for Accessible ICT Coalition*'[4] network has published several case studies [5] that provide various relevant business arguments for barrier-free ICT services. Around 200 companies participated in these case studies. It was found that companies investing in barrier-free and user-friendly ICT benefit from significant savings, an increased number of customers, and a positive image that strengthens business.

» Measures to introduce barrier-free technology not only benefit disabled persons, but they also yield positive side effects for other users.

Measures to introduce barrier-free technology not only benefit disabled persons, but they also yield positive side effects for other users:

- Clear Structuring: Proper utilisation of semantic HTML elements such as <H1>, <H2>, in headings are a key requirement in being able to provide assistive technologies for a website. Such a structured use of HTML naturally also improves handling for all users.
- Search Engine Optimisation: Search engine crawlers place similar demands on a website as a blind user: Both are unable to interpret the visual representation of the website and thus depend on the underlying semantic annotations that are implemented in the page's markup. Given

these limitations, both can only understand the content of a website if, for example:

- Images contain relevant alternative texts
- Metadata has been set for the language in use
- Title attributes are used correctly.

- Mobile Devices: Smartphone users are subject to limitations, derived from the small display and input options, which are similar to the limitations experienced by disabled users. For instance, a smartphone user is not always able to display an entire Web page on the small screen, so only a small portion of it is displayed at times. Users with strongly impaired vision face the same problem, because they need to use the screen magnification software. This makes it impossible for them to view the entire Web page at a glance; instead, they can only focus on small parts of the page. Clear visual boundaries and separated screen sections as well as highly visible controls are helpful to both groups of people.

» Clear visual boundaries and separated screen sections as well as highly visible controls help both smartphone users and persons with low vision recognise and use commands with greater ease.

- Ease of Use: Better usability for smartphone users comes as a free added benefit when adhering to the rules of barrier-free design, by devising large buttons, since larger buttons are easier to hit on a touch screen than smaller ones. This design also helps persons with motor disabilities, such as a ***tremor***, by making the functions easier to use.

4 Persons with Disabilities Utilise ICT

4.1 'Design for All' and Assistive Technologies

Just like any other tool intended to be usable by anyone, including persons with disabilities, hardware and software generally needs to be equipped with additional properties. Consider ATMs or ticket machines that cannot be used by blind persons or citizens with motor disabilities; or picture software intended for operation with a mouse only, making it unusable for all people who must rely on a keyboard.

» Just like any other tool intended to be usable by anyone, including persons with disabilities, hardware and software generally needs to be equipped with additional properties.

There are two methods to counter barriers, and they are particularly effective when used together:

1. Adhere to the '***Design for All***' Guidelines
2. Offer Interfaces for ***Assistive Technologies***

Following the '***Design for All***' guidelines means to create device/software user interfaces that allow as many users as possible to operate it without the need for additional aids. For example, an elevator could be furnished with an extra set of buttons placed at a convenient height for children and wheelchair users. Software controlled with a mouse should offer the option of using the keyboard instead, catering to the needs of visually impaired, blind, and persons with motor skills disabilities.

There are, however, certain user groups or exceptional situations where these measures do not suffice. For instance, special hardware and software may be required to provide access to ICT (***voice input***, ***screen reading software***, etc.). In this case, the product must provide an interface to

assistive technologies in addition to its own user interface. For software products this means supporting the ***Accessibility API*** to the underlying operating system. ***POS terminals***, for instance, could provide an extension for the users' mobile devices that enables persons with disabilities to operate them from their own barrier-free smartphone environment without physical interaction.

4.2 Barrier-Free Technology and Visual Impairment

Visually impaired users place a broad range of demands on software, depending on the degree of their impairment, which can be anything from a *minor visual impairment* or *colour weakness* and *colour blindness* through to *major visual impairment* or *blindness*.

The ***Design for All*** approach is suitable for all needs of this user group (with the exception of the most severe cases, such as blindness or major visual impairment). Possible measures include:

- Adjustable content sizes, fonts and colours
- Sufficient colour contrasts
- Using supporting selection properties in addition to colour for selections, status displays, and other key information.
- Catering to the critical need of this user group, to allow it to access all operations of the software via the keyboard.

It is equally important that user interfaces based on alternative operating concepts (for example, touch screens) meet all recommendations for barrier-free access of the respective platform.

» One of the central requirements is that all functions of the device or software be accessible via the keyboard.

4.3 User Experience when Utilising Magnification Software

Low vision users are dependent on **magnification *software*** to navigate software using their remaining eyesight. This kind of ***assistive technology*** differs from built-in magnification functions in various ways:

- High magnification (x10 and more)
- Position of input devices (cursor and mouse pointer) are more easily visible
- Options for fixing relevant screen sections into place

Figure 1: Software for screen magnification and alternative mouse pointers
© Freedom Scientific

All modern magnification systems also include a speech output functionality. It allows users to read large documents at a highly accelerated pace. Most users combine magnification and speech output functions when applying such software.

Magnification systems must offer clear visual boundaries for screen sections and highly visible commands for optimum functionality.

4.4 User Experience when Utilising Screen Reading Software

Assistive technology that provides access to a user interface in a non-visual manner is called ***screen reading software***, or screen reader. It presents users with all content and controls using ***speech*** and/or tactile output in the form of ***braille*** using a ***refreshable braille display***. The software provides access to ICT for blind persons or people with a visual impairment too severe to be able to use ***magnification software***.

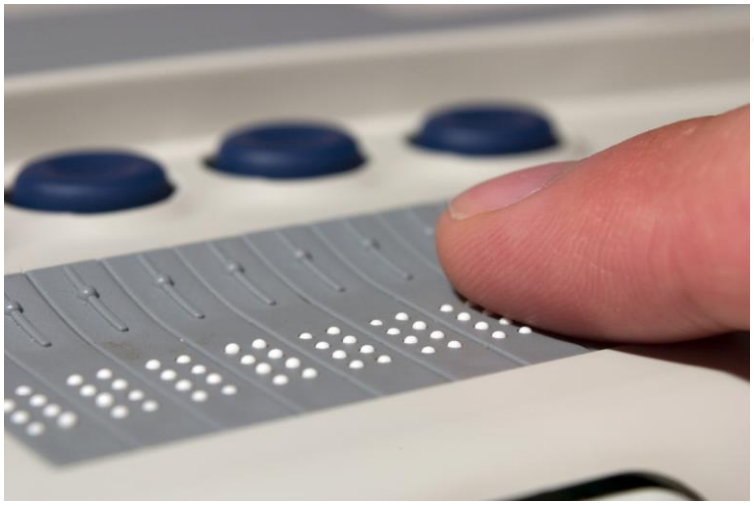

Figure 2: Refreshable b*raille display*

» Vision is three-dimensional allowing people to instantly capture an entire system state; however, hearing or the sense of touch is one-dimensional.

The key difference between using a mouse/screen and a ***screen reader*** derives from the different nature of the senses employed. Vision is three-dimensional allowing people to instantly capture an entire system state; however, hearing or the sense of touch is one-dimensional. ***Screen reader*** users would actually need to continuously read/listen to the entire content of the user interface from top to bottom in order to understand the precise system status. However, this would not be efficient and intuitive. The software must meet the following demands in order to work effectively for people:

- All controls and content have to be accessed via the keyboard
- All non-textual content needs alternative equivalents (texts for images, titles for windows and frames)
- The ***screen reader*** software needs a programmatic access to all visual relations (labels for form fields, headers for table rows and columns, etc.)
- The ***system focus*** needs to be placed in a workflow-dependent manner in the section where the next user action is most likely to occur
- The ***screen reader*** is informed about dynamic changes, ensuring that users are provided with error messages, warnings, and other automatic messages in due time

4.5 Users with Motor Skills Impairment

Users whose hands suffer from motor skills impairment have particularly demanding needs as regards interaction with ICT. Here, too, there is a wide spectrum of conditions, which encompass a vast range starting with a ***tremor*** and leading up to complete immobility.

This breadth of disabilities also explains the large number of alternative input devices:

- ***Mouth stick***
- Large keyboards
- Individual switches that can also be triggered by foot
- Eye control
- ***Speech input***.

The key requirement for this user group is that the software supports fully keyboard-based navigation and activation of all software functions. This also means that it will support a large variety of alternative input devices.

4.6 Users with Hearing Impairment

Hearing impairment covers a large range, similar to visual impairment. Whilst the ***Design for All*** approach is sufficient in countering the problems of users with limited **hearing ability**, users with deafness require alternative equivalents for all audio contents:

- Mandatory ***subtitles*** for audio tracks in videos
- Transcripts are required for pure audio content, including speeches, presentations, etc.
- Key information on public Web pages can be provided in the form of ***sign language videos***
- Content should be presented using ***easy-to-read language*** to help persons with cognitive disabilities and, readers whose first language is not that of the content, understand the message.

Figure 3: 'Thank you' using sign language

4.7 Users with Learning and Cognitive Disabilities

Depending on its target group, software should also be accessible for persons with cognitive disabilities and/ or learning/speech impairments. This concerns persons for whom at least one of the following tasks is difficult:

- Reading
- Writing
- Comprehending a series of steps
- Comprehending content
- Staying focused, etc.

Software adequately meets these challenges if it provides a very clearly designed user interface that does not offer too many options or too much content at the same time.

Users with cognitive disabilities also benefit from ***easy-to-read language***[6] and if textual content is complemented with consistent icons[7].

It is also important to know that persons with cognitive disabilities often require more time to perform operations. For this reason, any workflows with time restrictions must provide a means for temporarily and permanently extending the available time in the user settings. Most users of ***assistive technologies*** will also benefit from this feature since working with alternative input/output devices and methods generally takes more time than normal operation using a screen and mouse.

5 Organisational Measures

Increasing awareness of the need for barrier-free technology for persons with special needs calls for the need for entire companies and their products to become barrier free, backed up by legal regulations. In Canada and the U.S.,

two countries with the most progressive laws to protect the interests of disabled persons, some states require companies to provide their 'vision' regarding barrier-free environments and an associated strategic development plan covering multiple years[8].

This development means that, for cloud providers, more and more customers are demanding fully barrier-free cloud services.

» The degree to which software is barrier free is not a static figure that can be planned and defined once.

The degree to which software is barrier free is not a static figure that can be planned and defined once and for all. Like any other highly complex characteristic, it rather describes a process that must always be accounted for when planning and developing a product.

5.1 Barrier-Free Work Environments

Creating a barrier-free cloud solution requires clear organisational measures on the part of the provider, who must integrate the following considerations into the working process:

- Raising awareness for the special needs of persons with disabilities
- Clear decisions from the executive management level
- Technical expertise
- Integration at the product level

5.1.1 Raising Awareness for Special Needs

Each process for removing barriers from products is introduced by an initial trigger, such as:

- Customers or laws demand a change

- A decision-maker is made aware of the topic at a conference
- A motivated developer with the requisite know-how convinces decision-makers about the benefits of creating barrier-free software

» Raising awareness is a constant for making accessibility succeed.

The first step could be to build a business case[9] that demonstrates a positive ROI situation and illustrates that the company can gain market advantages by assuming social responsibility. After deciding to go ahead with the project, its implementation is planned and organised.

Raising awareness of the special needs of disabled persons makes the product decision-makers more sympathetic towards the needs of this user group. It can be increased through targeted actions such as discussions with disabled persons, the participation in workshops, conferences and exhibitions and by getting all relevant persons involved. Raising awareness in this way is a constant for ensuring the success of the project.

5.1.2 Clear Decision of the Project Manager

The process starts with a clear decision to create a barrier-free product. This decision is expressed by making a public statement and by sending a clear message to the internal product teams, tasking them with planning and implementing a barrier-free product.

Even though some ‘old-school’ usability experts still favor the waterfall method of software development[10], agile methods have clearly triumphed. The waterfall method of ‘first specifying and designing and then testing at the end’ is not conducive to introducing barrier-free technology[11]. Agile methods, such as Scrum, are much more suited for a barrier-free design. Barrier-free design greatly benefits from the quality assurance stage included in each sprint, defined as part of the ‘Definition of Done’ concept for all user stories.

5.1.3 Technical Expertise

Expertise is the key tool for any UI development team that wants to implement barrier-free technology. The organisation must secure the help of professionals specialised in barrier-free technologies to ensure the required level of expertise. Depending on the size of the organisation or the number and nature of the cloud products, this may be a single expert or multiple persons who are either hired or who participate in the project as external consultants. In either case, it is recommended that the development teams have constant access to these experts to build the required development and in particular quality assurance knowledge.

The accessibility experts perform the following tasks during the project:

- Analyse the status/level of barrier freedom of existing products
- Provide suggestions for improving existing products
- Integrate barrier-free design into the development processes
- Help plan new products or functions
- Transfer expertise by holding training seminars
- Evaluate and consult during the ongoing production process.

5.1.4 Integration on the Product Level

The product manager is in charge of implementing barrier-free design as it represents just one of the cloud product's various quality features. This includes having the product evaluated in cooperation with accessibility experts and integrating all proposals for a barrier-free product into the product planning process. In addition, the product manager is also responsible for ensuring that the development team is provided with sufficient know-how to implement the specific tasks and perform adequate quality assurance.

Again, keep in mind that accessibility is not a state but a process. What is true for product development also applies to barrier-free design. The team must keep constant tabs on the functionality, safety, and user friendliness.

5.2 Barrier-Free Design as a Requirement

The requirements for purchasing a new cloud service should include considerations regarding the barrier-free design of the product. This requirement will firstly generate awareness amongst cloud providers and will further provide a strong incentive to actually implement this requirement. Making this demand right now will mean that the European business sector will be ready for the upcoming legal guidelines on purchasing ICT in the public sector, which will come into force in the EU in 2014.

» The requirements for purchasing a new cloud service should include considerations regarding the barrier-free design of the product.

The demand for barrier-free products must not be phrased in a general fashion. The wording should consider the following aspects:

- The target group of the product also defines, in part, the target groups of persons with special needs that may use the product
- The prioritisation of different product segments (general operation, administration interface, development environment)
- The Evaluation and quality assurance along the entire lifecycle of a cloud solution

5.3 Barrier-Free Design as a Certified Quality Feature

Certificates and quality seals serve an important function, as they allow customers to evaluate the quality of a product and thus help speed up the selection and purchasing process.

More and more organisations, including EuroCloud, are developing instruments suited for determining or certifying the quality of products, and it seems likely that these developments will result in a Europe-wide quality seal of approval.

Considering that over 90 million Europeans belong to the group of persons with special needs, it is only logical to consider barrier-free design as one of the key software properties – and certification must account for this.

6 Technical Measures

This section addresses developers and quality officers working in the development teams of cloud providers.

It illustrates barrier-free design from a technical point of view. This includes a brief description of standards, regulations, and technical specifications as well as references to more detailed information.

6.1 Procedure

While it is much easier to implement a barrier-free design if it is part of the initial design and development process, most projects involve existing software that needs to be made barrier free.

Adding barrier-free functionality in retrospect is similar to introducing such features to buildings: The task is as complex as improving wheelchair users' accessibility to a building whose stairways, entrances, and toilets are too small. Had the needs of persons with special needs been accounted for in advance, the blueprint would have provided the right dimensions to allow easy access, which would have resulted in much lower total costs.

» It is much easier to implement if accessibility is considered from the very start.

The technology employed is the same, regardless of whether it is a new product or a later improvement. All UI components must be barrier free, which involves the following aspects:

- Device independence:
  Most devices used for input and output address specific senses. For instance, the user must be able to see the screen contents in order to be able to effectively use a mouse pointer. Along the same lines, only a person with sufficient hearing can comprehend the content of recorded speech. Both input and output for software must be possible independent of the device:
  - Operation of UI components with the mouse, keyboard, and touch screen
  - Alternative equivalents for sense-dependent content such as images, video, and audio. Text is the ideal alternative, as it can also be perceived by deaf and/or blind persons.
- Design for All:
  Most persons with special needs do not require ***assistive technologies*** to interact with ICT. The software itself should be designed in a user-friendly manner and offer ample user options for visual and audio settings. The key options are:
  - Font size scalable up to 200%
  - Sufficient contrast between background and text or an option to choose from various color schemes
  - Sufficiently large active surfaces for mouse clicks and on touch screens
  - Audio content whose background noise is at least four times lower than the foreground sound

- Semantic programming:
  Assistive technologies such as ***screen readers*** and ***magnification systems*** require complete semantic information on all user interface components. There are not yet sufficient barrier-free components for Web applications, as opposed to desktop applications, whose interfaces are generally programmed using standard components of an operating system – making them barrier free by default.
  Whether the so-called 'custom widgets' are barrier free or not lies in the responsibility of the developer. The widgets must be accessible and operable independent of the device used. Also, the semantics must be clearly defined: Role, name, and status of each component must be included in the markup of the host language. More information on this topic is provided in the next section.

6.2 Development Measures

Most current cloud applications utilize HTML5 and JavaScript (AJAX) as a basis for their UI components. Content is further enriched using PDF documents and various multimedia formats. This section aims at helping you understand how to implement a barrier-free software design. Towards this end, we will point out resources that provide you with guidelines and standards for barrier-free development.

6.2.1 'Design for All' Measures

The principles of '***Design for All***' include all demands related to barrier-free development and even expand on them[12]. In the case of cloud services, this developmental approach means a very high degree of user focus as well as simple and intuitive operation.

Cloud services can directly fulfill the majority of the above-mentioned principles. A small user group will still require additional software in order to be capable of accessing the ICT.

» Assistive technologies communicate with the operating system and software programs by means of a special interface called the Accessibility Application Programming Interface.

6.2.2 Handshake with Assistive Technologies

Assistive technologies such as ***screen readers***, ***magnification systems***, and ***voice input*** communicate with the operating system and other software programs by means of a special interface called the Accessibility Application Programming Interface (AAPI). Every common operating system provides such interfaces:

- Windows
  - Microsoft Active Accessibility[13]
  - Microsoft UI Automation[14]
- Linux
  - Accessibility Toolkit (ATK)
  - Assistive Technology Service Provider Interface (AT-SPI)[15]
- OS X
  - OS X Accessibility Protocol[16]

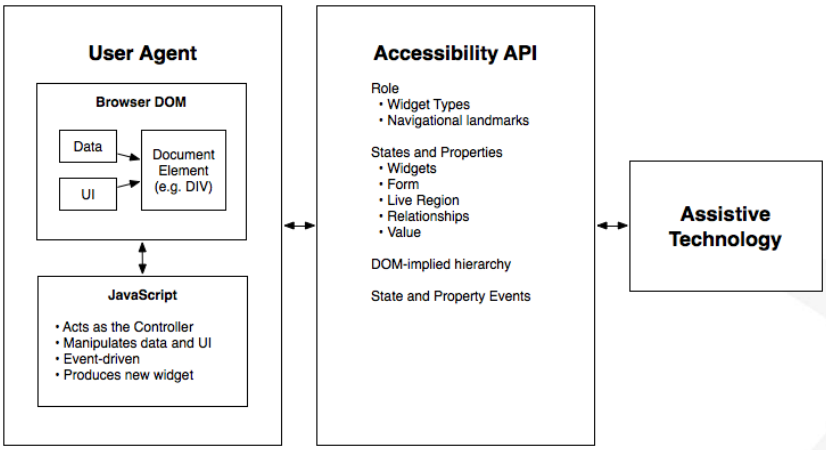

Figure 4: Accessibility API [17]

Programs implementing these accessibility interfaces respond to requests of assistive software according to the role, name, or current status of user interface components. This enables the assistive technology software to present the content and meta information in an alternative format in line with the needs of their users – for instance, as audio or tactile output in braille.

6.2.3 Websites

Registration, further information, and blogs for cloud services are mainly offered on websites. Traditional information sites rely on HTML, PDF, video, and audio to present the required information. In this context, forms and hyperlinks are the only interactive components offered by HTML.

» The 'Web Content Accessibility Guidelines' describe all measures that need to be observed to create barrier-free websites.

Assistive technologies retrieve information on the entire structure of a website from its 'Document Object Model' (DOM). The browser communicates the role, name, value, and state of a form field via the accessibility interface. The 'Web Content Accessibility Guidelines' (WCAG)[18] of the W3C Web Accessibility Initiative (WAI) describe all measures you need to observe to create barrier-free websites.

Websites increasingly offer documents and forms in PDF format. These, too, must be designed in a barrier-free manner. The 'ISO 14289 PDF/Universal Accessibility'[19] standard defines all relevant requirements.

6.2.4 Web Applications

Most cloud services are based on Web applications (Rich Internet Applications, or RIAs). Web applications use script languages (mainly JavaScript) and load content during runtime (AJAX), in contrast to websites, to achieve a highly comprehensive, intuitive, and downtime-free user experience by implementing an easy-to-use interface and through dynamic loading of content. Many of the components utilised in the user interface of Web applications (custom widgets) are not supported by the HTML standard. Most current Web applications realize these components without any semantics (DIV and SPAN elements), which means they are not barrier free.

So in addition to observing the WCAG guidelines, these applications must undertake special measures to create a barrier-free user interface. For this purpose, W3C/WAI provides the '*Accessible Rich Internet Applications*' (WAI-ARIA) technical specification[20]. The specification and its accompanying documents explain how you can design barrier-free custom widgets and provide you with the relevant tools.

» The WAI-ARIA technical specification explains how to create barrier-free custom widgets.

6.3 Evaluation and Monitoring

Websites and applications created as part of a cloud solution require regular evaluation and monitoring. The following quality assurance measures are recommended:

1. The team's quality assurance officer evaluates each newly developed or modified UI component during development. Before each release, the total accessibility status is evaluated as an additional measure.

2. User tests are organised at regular intervals. These tests should involve the whole range of users with special needs that are part of the cloud service's target group. The tests can be organised locally or online. The method of choice depends both on the target group as well as on the type of cloud services to be tested.

6.3.1 Quality Assurance Methods

» Only about 40% of the checkpoints derived from the WCAG guidelines can be tested automatically.

Only about 40% of the checkpoints derived from the WCAG guidelines can be tested automatically. However, there are several evaluation tools at your disposal[21]. Most tools can only test websites and are thus not suitable for evaluating Web applications.

The evaluation of cloud services critically depends on expert know-how and manual evaluation, given the present state of development (early 2014).

The *Web Accessibility Initiative* of the W3C provides a comprehensive set of training materials on evaluating the barrier-free design of websites and Web applications[22].

7 Checklist

The final section provides our recommendations on which standards for barrier-free design you should observe when developing platform software, websites, and Web applications for cloud services. For the sake of brevity, we have refrained from including the applicable standards and guidelines for creating barrier-free hardware in our checklist. We are hopeful that these or similar standards will find their way into the EuroCloud certificates.

Technology	**Standard**	**URL**
Software (desktop)	ISO 9241-171: 2008 – Guidance on software accessibility	http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=39080
Software (mobile apps)	BBC Mobile Accessibility Guidelines	http://www.bbc.co.uk/guidelines/futuremedia/accessibility/mobile_access.shtml
Websites / Web applications	W3C Recommendation/ISO 40500: Web Content Accessibility Guidelines (WCAG)	http://www.w3.org/WAI/intro/wcag

8 Glossary

Term	Meaning
AAPI	Accessibility Application Programming Interface: an operating system interface for communication among software applications and assistive technologies.
Accessibility	See: Barrier-free software design
ARIA	Accessible Rich Internet Applications: a technical W3C specification for implementing barrier-free Web applications; http://www.w3.org/TR/wai-aria/
Assistive technology	Hardware and software that provide suitable presentation alternatives, input and output methods, navigation aids, etc. to specifically support persons with special needs in gaining access to ICT.
Barrier-free software design	Software is considered barrier free/accessible if it can be used comprehensively by persons with special needs in a user-friendly manner and without external help.
Braille	Writing for blind persons based on tactile information. While there are different types of writing systems for the blind, braille (named after its inventor Louis Braille) is the most common.
Disability	Refers to an impairment that significantly impedes the ability of a person to participate in social and vocational activities; this limitation is a result of adverse environmental, social, or other factors

	(barriers) and characteristics of the disabled person that make it hard(er) or impossible for the person to overcome these barriers. Disability does not have to be permanent.
Design for All	A design concept for creating products usable by as many user groups (including persons with special needs) as possible without the need for additional software/hardware customization.
Easy-to-read language	Language used in a manner that is very easy to comprehend. Simplified language helps people understand texts. It specifically caters to the needs of people who, for whatever reason, have a low linguistic proficiency. It therefore also serves the purpose of barrier-free design.
Eye control	An operating aid: mouse pointer control and triggering of actions by tracking eye movements.
Focus	See: System focus
Magnification software	Renders visual computer screen information in a manner suitable for visually impaired users: size, colour contrasts, cursor shape. Is normally used on large monitors.
Mouth stick	Persons who can only move their head frequently use a mouth stick to operate the computer keyboard.
POS terminal	An online terminal for cash-free payment at a point

	of sale.
Refreshable braille display	A braille display, or braille terminal, is an electro mechanic device that produces braille output. Blind computer users utilise it in combination with screen reading software to read screen contents.
Role	Text or number allowing software to identify the function of a component within Web contents.
Screen reading software, Screen reader	An assistive technology for blind, visually impaired, or learning-impaired users. The software interprets the content of the output interface and relays the information to the user via voice, sound icons, or braille line output.
Sign language	A language that employs hand and arm movements as well as facial expressions and body postures to confer information.
Speech input	Automatic data capture or control of the user interface via voice recognition software.
Speech output	Acoustic presentation of textual content by means of an artificial, human like voice.
Subtitle	Synchronised visual alternative and/or text alternative for voice or other audio information that is important for understanding media content.
System focus	The position in the active window where keyboard input will be inserted.
Tremor	Shaking, involuntary, rhythmical contraction of

	opposed muscle groups.
WCAG	Web Content Accessibility Guidelines: W3C guidelines for barrier-free Web content.

9 Appendix A - Legal Situation in German-Speaking Countries

9.1 Legal Regulations in Germany

The *Equal Treatment of Disabled Persons Act (Behindertengleichstellungsgesetz)* (BGG)[23] requires all public Internet and intranet offerings of the German Federal Administration to be barrier free. The guidelines for implementing this requirement are defined in the *Federal Ordinance on Barrier-Free Information Technology (Verordnung zur Schaffung barrierefreier Informationstechnik)* (BITV)[24]. Each German state has formulated its own equal-opportunity laws and regulations that define the rules for barrier-free information technology for the state administrations.

All currently valid German regulations are based on the '*Web Content Accessibility Guidelines*' (WCAG)[25] of the *W3 Consortium's*[26] (W3C) *Web Accessibility Initiative* (WAI). However, they do not implement these guidelines as is, but rather adopt certain sections, thus focusing on different parts of the provisions. This practice bears considerable risks as it means that the websites and Web applications of the federal and individual state administrations may be subject to differing requirements.

9.2 Legal Regulations in Austria

The legal provisions regulating barrier-free ICT access in Austria are based on three laws: the *Federal Constitution (Bundesverfassung)*, the *Austrian Federal Act on the Equalisation of Persons with Disabilities (Bundes-Behindertengleichstellungsgesetz)*, and the *E-Government Act*[27]. The common denominator is to prohibit discrimination against persons with disabilities. As a result, information pages and services of public administrations as well as all other relevant information pages and Internet services must be barrier free. Any member of the affected group can submit a complaint against providers whose services are not barrier free to the

arbitration board of the Federal Social Welfare Office (Bundessozialamt). If no mutually satisfactory agreement is reached, legal proceedings can be initiated.

9.3 Legal Regulations in Switzerland

The Swiss effort to create a barrier-free Web is also based on the constitution and the *Law on Equal Rights for Persons with Disabilities (Behindertengleichstellungsgesetz)*[28] (BehiG). The *Regulation on Equal Rights for Disabled Persons (Verordnung zum Behindertengleichstellungsgesetz)* (BehiV) defines guidelines for barrier-free Web services of the federal administration. These stipulate that all Internet and intranet offerings of the federal government must adhere to the Web Content Accessibility Guidelines (WCAG 2.0) of the W3C. Conformity with level AA must be maintained. Starting in 2011, the Federal Chancellery (Bundeskanzlei) has been performing an annual inspection to determine whether this provision is being observed.

Even though the Swiss constitution prohibits discrimination against persons with disabilities and the BehiG demands equal treatment and opportunities in the public sphere, there are no provisions or concrete guidelines regulating barrier-free Web services on the canton and municipal level. The same applies to private service providers, who are not required to actively contribute to enabling barrier-free utilisation of their services.

10 Legal Notice

10.1 General Information

The information provided in this guide serves the purpose of illustrating special legal aspects related to cloud computing in a general manner. It does not represent legal advice and is not suited to replace such legal advice as this always requires precise knowledge of the individual factors and, in particular, the concrete case at hand.

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10.5 Fees

This guide is provided to the addressees/recipients free of charge.

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