Accessibility and Inclusion Requirements

Deliverable D22.7

Document Information	
Date	9.12.2013
Status	FINAL
Version	1.2

Related SP / WP	SP2/WP22.7	**Document Reference**	D22.7
Related Deliverable(s)	D22.1, D22.2, D22.3, D22.4, D22.5, D22.6, D34.1	**Dissemination Level**	PUBLIC
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This document is issued within the frame and for the purpose of the FutureID project. This project has received funding from the European Unions Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 318424

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Abstract

This document defines the accessibility and inclusion requirements to be taken into account when developing the different prototypes in the FutureID project. It also serves as a background document in informing project partners about different aspects of accessibility when dealing with ICT. This includes looking at definitions, different types of users, assistive technology, and other existing work in the field. Legal requirements, including storing of personal information for making systems accessible, are also covered. The document includes the accessibility and inclusion requirements for both developing and testing the client.

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History

Version	Date	Author	Changes
0.1	2013-04-19	Trenton Schulz	Initial version with TOC and abstract for M6 deadline
0.2	2013-07-05	Trenton Schulz, Eva Schlehahn	More background sections, classifications of people with disabilities.
0.8	2013-08-12	Trenton Schulz	Most requirements added, only missing legal requirements
0.9	2013-08-14	Trenton Schulz, Eva Schlehahn	First complete draft.
0.91	2013-08-15	Trenton Schulz, Eva Schlehahn, Marit Hansen, Harald Zwingelberg	Updates from Marit and incorporated comments from the first review.
0.92	2013-08-21	Trenton Schulz	Corrections from comments from Andreas, removed extra abbreviations that not everyone will know, nor need to know.
0.93	2013-08-22	Trenton Schulz, Eva Schlehahn	Included updated legal requirements from Eva and transferred all footnote references to references at the back.
0.95	2013-08-29	Trenton Schulz	Included comments from Detlef and fixed many small typography issues (based on *Bringhurst Practical Typography*)
1.0	2013-08-30	Trenton Schulz	Initial 1.0 Version
1.1	2013-10-29	Trenton Schulz	Clarification on AIR-05
1.2	2013-12-09	Trenton Schulz	Update terminology.

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1 About the Accessibility and Inclusion Requirements deliverable

This document specifies the accessibility and inclusion requirements for FutureID. It also provides background information about the area of accessibility and inclusion and provides references to resources to help in implementing accessible solutions. Beyond specifying the requirements, the document should work as a good starting point for anyone in the FutureID project to understand what is needed for accessibility and inclusion in the project.

1.1 Document scope

This document focuses on the requirements for the end-user software that is being made in FutureID, since that is where this document can influence the requirements. In doing so, it will take into account that there are different types of end users, such as elderly citizens, minors, or users with either physical or cognitive impairments. However, this document will not address the accessibility for administrators and developers of FutureID services. Thus, it also does *not* focus on the accessibility requirements for the hardware and infrastructure that is used in the project. That is, it does not specify requirements for the smart cards, smart card readers, mobile devices, or computers that will interface with or run the software the user runs in FutureID. This document *presupposes* that these items themselves are already accessible according to existing standards or that they have corresponding assistive technology installed and properly set up or allow a user to easily do this (see §§ 8.2 and 8.3 for more details). Since accessibility and usability cover similar areas (one can argue that accessibility is a superset of usability), it is also important to look at the usability requirements in D22.4 and additional legal requirements in D22.6.

Moreover, the scope of this document is restricted to the understanding of accessibility and inclusion in a direct way, thereby excluding matters of delegation from the analysis and requirements findings of this deliverable. It is acknowledged that delegation is one prominent way to enable end users to use modern eID solutions by e.g., involving other persons such as care staff, legal guardians, and other authorized individuals. But while this might be one possible approach, it has its drawbacks. The European Digital Agenda demands a further development of digital technologies with more ambitious goals for the inclusion of less able individuals in Europe. The Agenda foresees the ideal of a much more immediate and easy access to new technologies for those citizens. This way, these citizens shall be empowered to directly use digital services and goods independent from the help of other persons, so they get integrated further into society as fully self- determined individuals. Consequently, this deliverable is focused to name requirements that are by nature aimed at direct accessibility and inclusion for the end users.

1.2 Document organization

The document is organized as follows. The first seven sections are organized into background information in this area. The problem statement regarding the need to consider accessibility is presented in § 2 along with the target population for eID. In § 3, basic infor-

mation about the different types of disabilities is presented, divided into four major classes. Section 4 presents the terminology that is used in the field of accessibility, e-inclusion, and universal design. Section 5 covers legal issues including current legislation in the EU and its associated lands dealing with accessibility and inclusion. The section also discusses the use of personal data in inclusive systems and delegation. Section 6 is a brief survey of current assistive technology that is available and could possibly be used by FutureID users. Section 7 covers existing work on accessibility. This includes other research projects, guidelines, and programming guides that could be useful in implementing accessibility in the FutureID client. After all the background information, the requirements themselves are specified in Section 8. The document also includes an appendix that introduces two additional personas that can be helpful in implementing the requirements.

2 Problem statement

If the FutureID's project goal is to create an eID that will be used for everyone in the future, then it must make sure that the FutureID client is usable by everyone, regardless of ability. That means that the FutureID client needs to be flexible enough to make it accessible to people with different disabilities, while still providing the guarantees for security and privacy that will take FutureID beyond the state of the art. This document hopes to help define requirements for accessibility that will help FutureID achieve this goal.

Before defining the accessibility requirements for FutureID, let's take a look at the different groups that will be using FutureID. We will then go on to look at the different types of disabilities that need to be kept in mind when designing a system. Finally, we will look at possible methods for addressing these issues.

2.1 Target population for eID

If eID will be the preferred method for providing identification for a person, then there is a very large population that needs to be addressed. This includes different economic levels, different ages, different cultures, different skills, and different abilities. The issue also is that the eID needs to last a lifetime for the user. If we just look at the life of one person—let's call him Bill—we can see that there are different issues that need to be solved.

In Bill's childhood, he may not be so aware of the need for eID, but it probably is needed for many different things like registration for daycare, school, and vaccinations. Likely, it is not Bill that will be the main user of the eID, but his legal guardians.

When Bill gets older he will no doubt get control of his eID. He may even wish to add extra security to show independence from his guardians. Let's speculate that Bill chooses to get a device that helps make his eID more secure by showing a one-time code. This device is small and easy for him to use, and he feels that he is more secure than the average person with his advanced technology.

Yet, as Bill gets older, the device that shows the code isn't as easy to see as it used to be. He must always find his glasses to read and have good light. He needs to change to something that is more accessible for him. He migrates his eID to work with a device that has a big display, making it much easier for him.

As time goes on, Bill's eyesight gets worse and even reading the big display is difficult, he needs to change to another device that reads things aloud. Bill uses this and a combination of other assistive technology to use his eID wherever he needs. He has also found having the interface being "easier to use" is helpful, since it is difficult to remember the order to perform actions.

This is an example of how the needs of users change over their lifetime, and how things that may seem to be "only used by people with disabilities" actually are useful to everyone. Con-

sider the option that FutureID is designed such that it can adapt to users' needs and would not need to have a complex and expensive transfer process. We have also just looked at one person that has one set of skills. We can expect that we will have users with different skill sets as well. Some users may be very interested in security and want everything secure, while others may have little interest in security and use eID only because they must. Yet, others may have cognitive impairments that make it difficult for them to operate eID, but it should still be possible for them to be able to use eID and be secure. Going back to our example of Bill above, his skills change as he ages as well, at first gaining more of them, while eventually stopping or even reverting back to simpler skills.

One way to keep the ideas of the users in mind is to use *personas*. Personas represent stereotypical users that make it easier to relate to than a large group of people. Personas are also being used in D34.1. We will present two personas that will help represent people with disabilities in Appendix A.

3 Working with different disabilities

A disability can have a small or large effect on a person's life. There are many different ways that disabilities can be classified. For example, Keates [1] looks at different surveys of disabilities and impairments and comes up with three general classes that would be of interest when working with human-computer interaction: motion (covering locomotion, reaching and stretching, and dexterity), sensory or perception (covering vision and hearing), and cognitive (covering intellectual function and communication). The ISO-IEC Guide 71 [2], which proposes guidelines for addressing the needs of older persons and people with disabilities in standards work, divides disabilities up into three classes of sensory, physical, and cognitive and allergies. Finally, Henry [3] also asserts that sensory, physical, and cognitive are the most common ways of classifying impairments, but suggests dividing them specifically into four classes: vision, hearing, physical, and cognitive impairments. Since Henry's work is the most related to user-centered design in information and communication technology (ICT), we will use this classification for the requirements.

3.1 Classes of disabilities

One thing to keep in mind is that there are different degrees of these impairments and there is no "average" person to represent all levels of these impairments. Some people may be impaired temporarily (e.g., breaking a leg adds a mobility impairment) and some may be impaired from birth or develop them as they age. Also keep in mind that different disabilities are not necessarily mutual exclusive. Comorbidity refers to situation where two conditions are present simultaneously in a patient. Someone who is deaf and blind needs different solutions than someone who is only deaf or only blind.

3.1.1 Hearing impairment

This class covers all levels of hearing impairment. This includes minor hearing loss to being completely deaf. The environment can also create the effect that someone is hearing impaired. For example, if the ambient noise in the area is loud enough, one can easily miss sounds that normally are heard like the ringer on a mobile phone. Another example can be wearing special headphones that block out most noise rendering the wearing essentially deaf to the outside noise.

As part of the aging process or through prolonged exposure to loud noise, everyone begins to suffer from some degree of hearing impairment. There are multiple ways that people compensate for this. Some people become good at reading lips, others use hearing aids to amplify sounds. Many, however, do nothing.

3.1.2 Vision impairment

Usually when one thinks about accessibility for ICT, the thought normally goes to people who are blind. Since we receive more than 80% of information visibly, it can be difficult to imagine how it is without sight when one has sight. However, vision impairment covers a wider range of people, not just those that are blind. For example, near-sightedness, far-

sightedness, or other common problems that can be dealt with corrective lenses are also types of visual impairment. Here is a quick review of different types of vision impairment, but is nowhere near exhaustive. We will focus on the impairment itself and not on the different diseases that cause these impairments.

Vision impairment also includes people who are colorblind, with red-green colorblindness being the most common version. People with red-green colorblindness cannot distinguish between red and green. So, while these colors have a connotation of “green is good” and “red is bad” in western societies. People with colorblindness need additional cues (such as position) to differentiate the signals.

Low vision is a category of people that cannot read things (like a newspaper) at normal viewing distance, even with corrective lenses. This usually requires some sort of assistive device (for example, more light or larger text). Being myopic (unable to see distant objects clearly—near-sighted) or hyperopic (unable to see close objects clearly—far-sighted) can also be classified here depending on how severe they are.

Visual impairment also covers conditions that limit the field of vision as well. A normal field of vision is 180 degrees. For example, tunnel vision is a condition where people can only see a small section in their center of vision, but nothing in the periphery. This results in missing information that is not presented in the center of sight.

Legal Blindness refers to having vision that is so poor that a person has less than 6/60 vision in that person’s best eye even after the best correction (i.e., a legally blind person would have to stand 6 meters from an object with corrective lenses to see it as clearly as normally sighted person could see at 60 meters. Legally blind also includes people that have less than 20 degrees in their field of vision. Totally blind refers to people who have vision worse than this.

3.1.3 Physical impairment

Physical impairment refers to a condition that limits either fine or gross motor ability. Respiratory diseases and epilepsy can also cause impairment in mobility. Mobility impairments can have consequences for how things are designed. For example, if a person is confined to a wheelchair, that person needs a certain amount of space to maneuver a wheel chair to work with a machine. That person also has a limited area to reach for things—both high and low. This means that things should be easily in reach for the person.

Rheumatic disorders, medical problems that affect joints and connective tissue, also can cause mobility impairments. A person with a rheumatic disorder may have a reduced range of motion or it may cause pain to perform certain actions. Diseases like Parkinson’s disease may cause a person to have joints that shake so much that it is difficult for them to perform fine movements. This also may have implications when using a touchscreen since a shaky hand may make it difficult for the touchscreen to register touches accurately. The result is that the objects on the screen may not activate.

3.1.4 Cognitive impairment

Cognitive impairments include things that act as a barrier to the cognitive process. This includes disorders like mental retardation, learning disorders like dyslexia, or even impairment by drugs (for example, drinking too much alcohol). Mental illness may also result in cognitive impairment. When travelling a foreign country, a person that cannot read, write, speak, or understand the language could be considered to have some type of cognitive impairment.

Of all the impairments, cognitive impairments are those that are the least understood, and they run quite a range. There are usually implications in the time that is needed to complete a task and the amount and the complexity of the text. However, this does not cover everyone. For example, people with dementia are normally not allowed to enter into any sort of binding agreements, and this falls on the shoulders of the guardians.

4 Accessibility and inclusion definitions

There are several terms that used when discussing accessibility and technology like: accessibility, e-inclusion, and universal design. All of these terms refer to slightly different things and it can be confusing if we refer to the wrong things. In this section, we will try to clear up these differences.

4.1 Universal Design, inclusion, and e-inclusion

Universal design is a term that is used more in the Norway and the United States than it is in Europe. In the rest of Europe, *inclusion* normally covers the same principles, with *e-inclusion* indicating a specific focus on making technology usable for everyone. Since these principles are defined in terms of universal design, we will use universal design for this section.

The original definition of universal design comes from Ron Mace [4]:

Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

That is, a product or environment that is universally designed can be used by everyone without any need for adaptation. An example of this can be a building that is laid out using slight ramps and railings instead of stairs to solve elevation issues. There is no need to add elevators or alternate means of moving around. Everyone can use the same area. The Center for Universal Design at North Carolina State University [5] has created seven principles for Universal Design:

1. Equitable use
2. Flexibility in use
3. Simple and intuitive
4. Perceptible information
5. Tolerance for error
6. Low physical effort
7. Size and space for approach and use.

Universal design can refer to both a method and an outcome. That is, one applies universal design principles (or to use European terms: one thinks inclusively about all the possible users) and includes the needs of people with disabilities during the design, implementation, and testing (including people with disabilities) of a product or service; the result is something that is universally designed (or inclusive). The aim here is to have universal design included from the beginning and not add it on at a later phase of a project.

4.2 Accessibility

There are some varied definitions about accessibility. One popular definition is the idea that making something accessible means that you create something that is usable for people

with disabilities. Another definition is to create something that is usable by the most people possible. It's very subtle, but the second definition encompasses a much larger group. Usually the idea with accessibility is to create hooks in a product or service so someone with proper assistive technology can make use of the hooks. Using the idea of a building from the previous section, when one uses universal design, one creates a ramp to make it possible to move up and down, whereas accessibility would involve adding elevators to the design.

This also means that you can create alternate ways of accessing something. For example, a web (HTML) document tagged with proper headlines, having alternate text for pictures, tables marked correctly with headers, etc. will be accessible to people who have screen reading software, since they can read it. Search engines can use these tags to have a better idea of what is on a web page (after all a search engine robot is "blind" as well). It doesn't mean the web page is universally designed (for example the style sheet for a page could render the entire page unreadable to people with sight, or it might be in a language that your audience doesn't understand).

Especially for existing products and solutions, making the existing product or solution accessible is an easier task than trying to redesign it for universal design. This is also true for software because it is easy to add the hooks for assistive technology. It is still important to test out these solutions to make sure that a solution is actually usable with assistive technology. This usually requires users that are familiar with an assistive technology to be able to test this optimally. Examples of assistive technology discussed in § 6.

5 Legal issues

In this section, we present some legal principles and requirements for accessibility and inclusion in the European Union. To enable an overview that may be useful for a number of European member states, we mainly focus on the rather generic legislation on European level. This is due to the fact that this legislation lays the foundation for the implementation of further defined requirements within the national law of the European member states. We then present some central requirements from selected EU member states to provide some tangible examples of implementation in national law. Moreover, we introduce to general principles of delegation matters in § 5.3 and conflict issues of personal data protection in the context of provisioning aid to disabled individuals in § 5.2.

5.1 Legislation about accessibility

The umbrella principles of accessibility and inclusion are codified in the UNO Convention on the Rights of Persons with Disabilities and its Optional Protocol, which was adopted by the United Nations General Assembly on 13 December 2006. With 20 ratifications and 155 signatures by 130 parties overall, it is the convention with the highest number of signatories in the history of international Human Rights support. The Convention came into force on 3 May 2008 [6]. In its Article 3, this international instrument statutes eight fundamental principles, which present a basic understanding of accessibility and inclusion for disabled people. Those principles are:

- *Respect for inherent dignity, individual autonomy including the freedom to make one's own choices, and independence of persons*
- *Non-discrimination*
- *Full and effective participation and inclusion in society*
- *Respect for difference and acceptance of persons with disabilities as part of human diversity and humanity*
- *Equality of opportunity*
- *Accessibility*
- *Equality between men and women*
- *Respect for the evolving capacities of children with disabilities and respect for the right of children with disabilities to preserve their identities*

Beyond these most basic principles, the Convention poses general obligations upon the signing states as well as further commitments to undertake realization efforts in various ways (cf. Articles 4 ff.). Inter alia, these commitments shall require the signing states to enable disabled individuals to have independent, full, and equal access to information and commu-

nication, thereby including ICT technologies and systems. In doing so, appropriate measures shall be taken to identify and eliminate obstacles and barriers to accessibility, resulting in a number of further specified requirements in various areas (Article 9). In the context of eID systems, the most relevant requirements are stated in Article 9 under ¶ 2 (g) and (h), cited as follows:

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2. States parties shall also take appropriate measures:

[...]

(g) To promote access for persons with disabilities to new information and communications technologies and systems, including the Internet;

(h) To promote the design, development, production and distribution of accessible information and communication technologies and systems at an early stage, so that these technologies and systems become accessible at minimum costs.

Thereby, to comply with these requirements, it is vital for the FutureID project to take into account the most appropriate and effective measures for achieving accessibility right from the start. However, the Convention does not state any more specific requirements, and thus remains at a rather generic level.

Within the European Union, accessibility and inclusion are addressed in various legislative acts. To codify legal requirements, the EU has two main tools for achieving the desired purposes: Regulations and Directives. While Regulations are specified acts embodying directly applicable law for each member state of the EU, Directives are rather an umbrella framework. Such a framework states the minimum requirements of the matter at hand and leaves it up to the European member states to implement these into their national law as they see fit. However, a specific legislative instrument posing accessibility and inclusion requirements for eID systems in particular does not exist yet. However, in the wake of the European Digital Agenda, a Regulation proposal on electronic identification and trust services for electronic transactions in the internal market was made in June 2012 to enhance the trust in online environments [7].

Such a proposal would be applicable to eID technologies and systems since they are or may be part of electronic identification and trust services in electronic transactions

With this proposal, the EU has the intention to enable secure and seamless electronic interactions between businesses, citizens and public authorities with the ultimate goal to increase the effectiveness of public and private online services, e-business and electronic commerce in the European Union. However, the proposal also states only very generic demands for accessibility. Article 12 of the proposal states that trust services provided and end user products used in the provision of those services shall be made accessible for persons with

disabilities whenever possible. But just as the demands of the UN Convention, this requirement is rather broad and states no specific requirements for technology and system design of eIDs and allocated services.

Despite the lack of a EU Directive specifically tailored to eID contexts, a number of Directives mandated for digitally provided services and communications may be applicable. These are:

- Framework Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services and its amending acts,
    - Thereby stating a general demand for accessibility measures in its Article 8 ¶ 2 a [8]
- Related Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and user's rights relating to electronic communications networks and services (Universal Services Directive),
    - Thereby demanding accessibility measures e.g. in the Articles 6 (1), 7 (1) + 7 (2), Article 11(2), 25 (2), 26, 31 (1), and 33 (1)[9].
- Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications) and its amending Directive 2009/136/EC
    - Thereby the amending Directive demanding easily accessible contracts for connections to a public communications network and/or publicly available electronic communications services in its Article 20 (1), as well as demanding easily accessible transparency and publication of information comparable, adequate and up-to-date information on applicable prices and tariffs, on any charges due on termination of a contract and on standard terms and conditions in its Article 21 (1).
- Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts,
    - Thereby making generic demands for public contracts to take into account accessibility requirements for disabled people in technical specifications, including electronic purchase systems, in the Preamble §§ 12 and 29 and Article 23 ¶ 1[10].
- Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors,
    - Thereby making generic demands for service, supply, or works contracts to take into account accessibility requirements for disabled people in technical specifications in the Preamble section 42 as well as in Article 34 ¶ 1 (a) and (b)[11].

However, all of these Directives still state a very generic approach without naming specific requirements in the regulated areas and sectors. Common for all Directives is that service providers in the mentioned sectors and industries are required to undertake measures for enabling unequivocal access for disabled people. At least, the Directives 2004/18/EC and

2004/17/EC take up a focus on the technical realisation possibilities by stating demands for technical specifications. However, to achieve the goals of the Directives, the European member states are always obliged to ensure the realisation by further specified national legislation and eventually, by supervision of national regulatory authorities.

Examples for national implementation tackling accessibility matters can be found in Germany's Equal Opportunities for Disabled Act (*Bundesbehindertengleichstellungsgesetz*), the Ordinance on the Creation of Barrier-Free Information (*Barrierefreie Informationstechnik Verordnung*, BITV) as well as Norway's 20 June 2008 Act No 42 relating to a prohibition against discrimination on the basis of disability (the Anti-Discrimination and Accessibility Act), and Spain's Royal Decree 1494/2007, of 12 November, by which approves the Regulation on the basic conditions for the access of disabled people to the technologies, products and services related to information society and means of social communication [12]. Still, these national legislative approaches provide very little guidance regarding specific technical requirements suitable to achieve accessibility. At least the aforementioned Spanish Royal Decree 1494/2007 refers to the principles of the Web Accessibility Initiative (WAI) of the World Wide Web Consortium. However, these principles will be elaborated about later on in this document (§ 7.1.1).

Beyond these legislative acts, the European Union explicitly recognized that ICT systems have become an important part of everyday life of European citizens by the so-called Declaration of Riga. This Declaration is a result of a 2006 meeting on the occasion of the European Ministerial Conference themed *ICT for an inclusive society* [13].

In the Declaration, it was also acknowledged that a so-called eAccessibility and usability shall be part of the future e-Inclusion Agenda of the European Union. Thereby, the eAccessibility provisions in EU legislation on electronic communications and terminal equipment shall be fully implemented, using all other instruments available, from voluntary industry commitments to new legal provisions at EU and national level where appropriate. To evaluate the effectiveness of these various instruments, a regularly assessment shall be conducted.

Taking further binding steps towards this goal, the European Commission adopted a Communication on e-Inclusion in 2008, which assesses the achievements since the Riga Declaration and sets goals for the future of an integrative information society. These goals include a stronger reinforcement of made commitments such as equal participation in the information society also by enhanced accessibility. This comprises not only the inclusion of disabled people, but also those with varying health conditions and elderly citizens. The ICT industry is required to make stronger realisation efforts for inclusion, for instance by intensified implementation and standardisation of accessibility measures [14].

Some first steps into this direction have been made by the industry, mostly in the area of web content display and information or communication interfaces. The international World Wide Web Consortium (W3C) conducted a standardization effort for accessible web pages in the form of the Web Content Accessibility Guidelines (WCAG) and Accessible Rich Inter-

net Applications (WAI-ARIA). On 15 October 2012, the second revision of the WCAG (WCAG 2.0) was turned into an ISO/IEC International Standard (ISO/IEC 40500:2012) [15].

Currently, many digital technologies and systems are closely linked to web connection and the provision of user services via networks. However, the correlating user interface controls are becoming increasingly advanced and complex, making it more and more difficult to achieve easy and effective interaction with the users. It must be taken into consideration that potential service customers possess widely differing knowledge and ability to use the technology giving access to these services. Thus, making user interfaces accessible and useable by the largest possible number of persons is a crucial factor of access to and success of the offered web services.

In this context, these W3C documents might be of use in the context of eID due to their general focus on making advanced web applications accessible for disabled users. Hence, both the WCAG and WAI-ARIA are useful resources for development and are covered in more detail in § 7.1.1.

Beyond these legislative statutes as well as the aforementioned standardisation efforts, contractual approaches are another way of achieving increased accessibility throughout Europe and worldwide. So for instance, in the sphere of publishing works, the World Intellectual Property Organisation (WIPO) decided in favour of easier access for disabled individuals at a diplomatic conference in Marrakesh in June 2013. In doing so, the so-called *Marrakesh Treaty to Facilitate Access to Published Works for Persons who are Blind, Visually Impaired, or otherwise Print Disabled* was adopted on 28 June 2013. This treaty manifests less stringent requirements for statutory exceptions with regard to intellectual property to enable accessibility for people with visual impairments. This enables for example the publication of literature works in braille or other accessible formats, the distribution of such works across international borders, or the suspension of Digital Rights Management function for such purposes. But also this treaty poses no substantial technical requirements to be realized for the goal of accessibility and inclusion [16].

Due to the lack of specific legal requirements regarding the technical realization of accessibility and inclusion, it seems that in the long- term, European legislators are called for action to remedy this shortcoming. However, it might be reasonably assumed that such regulatory gaps are maintained on purpose, owed to the rapid developments and emerging possibilities of technology. These naturally make it difficult to keep up by corresponding legislative acts. Therefore, it seems that technical measures necessary to realise accessibility can only be determined through a close assessment of the factual context in question, the desired user interaction, the main user interaction points, and the cornerstone goals of the individual services offered in relation to the user spectrum. In doing so, the further development of the FutureID concepts and architecture definitely should be taken into account and further specified to enable a more hands-on approach to what is actually needed for making their services available to an enhanced spectrum of users.

5.2 Personal data in inclusive systems

Often, when digital services strive to provide accessibility and e-inclusion, this encompasses and extension of the system design to complement and enhance the standard design of the technology. Logically, such preconditions that such a system has inbuilt functionalities to be activated in a flexible and even adaptive way. However, this requires the system to obtain awareness regarding the desired features, thereby classifying the various ICT skills, needs, preferences and physical or mental abilities of its users. In the following, we will elaborate how this evolves into potential issues of privacy and data protection which conflict the goal of assistive technologies to provide services tailored to the needs and demands of a broader spectrum of end users.

5.2.1 Personal data protection in the context of eID technologies and systems accessibility

In a first step to learn if there might be problematic issues in relation to data protection, it is crucial to determine if data protection law is generally applicable. Thereby, we refer to the European legislative umbrella framework in form of the European Data Protection Directive 95/46/EC [17]. The basic condition of its applicability is that personal data processed. Article 1 (1) states that the Directive is meant to protect the fundamental rights and freedoms of natural persons, and in particular their right to privacy with respect to the processing of personal data. So basically, there is a three-element precondition manifested for the applicability of the Directive: Data must be concerned, data must be subject to some form of processing and this data must be personal. To determine if any data that might be concerned must be considered as being personal, Article 2 lit. a) of the Directive provides for a statutory definition, which states that:

…'personal data' shall mean any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity;

This definition makes clear that only natural persons enjoy the protection through the Directive, excluding governmental institutions, corporate bodies and other legal entities. In its Opinion 4/2007 on the concept of personal data, the Article 29 Data Protection Working Party clarified that information being related to an identified individual mean a distinction of this individual among a group of several persons without doubt. But the protection scope of the Directive goes even further by being extended to the possibility of being identified. Examples for bits of information leading to the identification or just the identifiability of an individual are the name, address, telephone number, a civil registration number or an email address of the person that could be linked to her.

According to Article 2 lit. b) of the Directive, it doesn't matter if the processing operation in question is conducted by automated means or not, which is stated in Article 3 (1) as well. This technology-neutral wording has the effect that the legislative framework avoids being

detrimental to new technical developments and new digital services involving the processing of data.

In the context of FutureID, the processing of data can be assumed as being the typical case. By offering a broadly usable identity management infrastructure throughout Europe, potentially related identity management services are meant to process core identity related information of users. Moreover, by integrating already existing eID technologies, credential technologies, and trust infrastructures, the management of identity claims by nature involves the processing of personal data. So we consequently assume that the provisions of the European Data Protection Directive 95/46/EC generally apply to the processing of data for all service models envisioned by FutureID.

This is all the more the case for any data processing in the context of offering accessibility and inclusion features within these eID services. It may even be not only personal data may be affected, but also special categories of personal data as defined in the European Data Protection Directive 95/46/EC might be involved. When this is the case, the bar for the legal processing of such data would be significantly raised because its processing is generally prohibited except in cases of specific permissive law or explicit and valid consent of the concerned user. According to Article 8 (1) of the Directive,

Member States shall prohibit the processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, and the processing of data concerning health or sex life.

In general, the display of information for the users on screens as well as the communication between the users and service provider(s) itself triggers the necessity of having a coherent, accessible user interface. However, such inclusive user interfaces potentially require the system to collect data related to the disabilities or other shortcomings on user side which hinder them from accessing the services. It may well be that some features may be provided in such a way that the information is only stored locally and under the control of the user (e.g. by defining the settings of mouse and/or touchpad controls, or font size in locally installed applications). But other features cannot not simply be activated and run locally, but may need interactive modification of the user interface triggered by communication processes with the user herself. This would entail a transmission of the desired accessibility feature and its precise settings optimization. Examples would be enhanced user profiles stored on the servers of the service providers, or adaptive systems recognizing difficulties of users when trying to access and avail oneself of a service. However, such features eventually enable the service providers to draw logical conclusions about the very nature of the difficulties and impairments the user may have. Such conclusions can entail a broad range of information related to difficulties caused by physical hurdles, e. g. by visual, acoustic, or motoric impairments as well as caused by mental factors like cognitive impairments. In chapter 3.1 (classes of disabilities), a multitude of potential issues was introduced which end users can have due to personal circumstances, making them dependent on inclusive systems. Most of them are closely linked to medical conditions of either physical or cognitive nature.

Consequently, it can be said that the provision of accessibility and inclusion features in adaptive eID systems typically requires the processing not only of personal information, but even of especially sensitive personal data in the sense of Article 8 (1) of Directive 95/46/EC. Thus, it seems necessary to assume that the European Data Protection Directive 95/46/EC is applicable, thereby granting concerned individuals the protection of this legislative framework. In the following, we will elaborate on the consequences and requirements for a lawful processing of such personal data.

5.2.2 Legal ground for the processing of personal data to achieve accessibility

Against the previously elaborated findings, it must be assumed that the processing of user's personal data is the standard case for FutureID-linked services and infrastructures. However, this demands a legal ground, as stated in Article 6 lit. 1 of the European Data Protection Directive 95/46/EC that states, that the processing must be conducted fairly and lawfully. Without such a legal ground, the processing of personal data is in principle prohibited, making any operations without legal basis illegal. The Article 7 of the Directive mentions a number of possible legal grounds. Generally, the most relevant in the context of FutureID could either be the existence of unambiguous consent of the concerned user (data subject), or the necessity to fulfil a contract between the service provider and the concerned user. But it must also be taken into account that in the context of providing accessibility and inclusion features, eventually the special case of processing sensitive data (i. e. health data) applies; therefore even stricter legal preconditions must be fulfilled to guarantee the lawfulness of the processing operation. So if the service provider wants to legitimate the processing by consent of the concerned user, Article 8 lit. 1 + 2 of Directive 95/46/EC demands that this consent was given explicitly, informed and voluntary. Moreover, the processing of such sensitive information imposes much higher obligation of the side of the service provider to protect the data by appropriate technical and organizational measures.

Especially in the context of accessibility and inclusion, obtaining a valid consent from the user may pose a problem of factual nature. Depending on the type and severity of impairment, the concerned user may under circumstances not be able to give her consent at the relevant time. Thinkable would be situations where FutureID-related identity management services need to obtain data about the user's needs for accessing the service itself in the very first place. Only in a second step the service provider(s) would then be able to adequately provide information about the service they are offering under which conditions, e.g. by adapting screen display settings, activating acoustic subsidies, or accepting alternate input modis. But exactly this information is most crucial for the users to learn what the service is about and to what they are precisely required to consent to. Also, such an adaptive system recognizing either physical or cognitive difficulties on user side enable the service provider to learn sensitive information about potential new users without consent yet given. To avoid the storage of this user data on the servers of the service provider, it could be thinkable that a third party entity takes over the task of providing the accessibility features as kind of "trustee translation" of the user's needs. This would have the advantage that the service provider does not learn identifying information about the user. The disadvantage would be the risk that the new trustee entity obtains information about the nature and content of the

communication between user and service provider. But, regardless who provides the accessibility features, appropriate technical and organizational measures to protect the data must be implemented.

So necessary would be an earnest assessment which accessibility features really require the collection of personal data by the service provider(s). Also thinkable could be some features designed in a way to store settings and profile information locally on the device of the user and under her direct control. And those accessibility features which would require an interaction between user and service provider need to be closely regarded with respect to potential risks to the personal information processed. This includes necessary technical and organisational measures to protect that data as well risks of generating profiles without the user's consent.

Also an issue is the voluntariness of the consent because fully accessible eID systems are not yet broadly represented on the market, thus users not consenting giving their data for processing are mostly excluded from using digital identity management services at all. Exactly this outcome is meant to be avoided by the aforementioned principles and general demands on legislative level requiring accessibility and inclusion from the technologies and systems themselves. So, some kind of balance must be found to enable users to participate in eID usage in the digital sphere without forcing them to disclose personal and eventually very sensitive information about themselves. Rather, the empowerment of impaired users to freely decide at an early stage of the interaction with service providers should be the ultimate goal. Similarly, minors and elderly people limited in their ability to engage in digital interaction for using eID system should be empowered to access related services. This should be not only to safeguard the lawfulness of data collection and processing, but also to achieve a satisfying user experience equal to those of user's without any kind of physical or cognitive disadvantage.

5.3 Delegation

Delegation is defined as follows [18]:

"Delegation is a process whereby a delegate (also called "proxy", "mandatory" or "agent") is authorized to act on behalf of a person concerned via a mandate of authority (or for short: mandate).

The mandate of authority usually defines in particular

1. the scope of authority for the actions of a delegate on behalf of a person concerned and
2. when and under which conditions the delegate gets the power of authority to act on behalf of the person concerned.

The delegate shall only act on behalf of the person concerned if the delegate has the actual power of authority and if his action lies within the scope of authority. [18]

The mandate of authority is issued by the delegator (also called “mandator”). This may be the person concerned herself, but there are also cases where other entities explicitly decide on the delegation (e.g., in the case of incapacitation of a person the guardianship court rules on delegation) or where the delegation is foreseen in law (e.g., when parents are the default delegates of their young children).”

Delegation can be regarded as an assisting mechanism for persons[1] who cannot or are not willing to act on their own. Thus, delegation is not limited to persons with specific accessibility needs. Also, developers should not prefer delegation over solutions that enable the person to maintain control without external help.

Still, there are situations where delegation is foreseen in the current civil legal framework, e.g. when regulating legal representation or agency which have an effect also with regards to potential FutureID contexts. Usually, the support for delegation would be provided by the Service Providers or by the eID systems within their own scope; the FutureID system would not necessarily be aware of delegation solutions in place provided by external stakeholders. However, there may be situations where the FutureID system would offer own delegation options, e.g. for users’ convenience who are using own accounts in the FutureID system and would like to get support by delegates. Moreover, the FutureID client design may be influenced for users who are acting as delegates themselves and therefore handle not only their own eIDs, but also specific, often temporarily or conditionally limited, eIDs on behalf of other persons. This is considered add-on functionality and will not be part of those requirements whose realization will be prioritized for the FutureID system.

Note that the implementation of a delegation solution is not limited to the creation and use of eID tokens, but requires an elaborated concept including the appropriate workflow of issuing, changing and revoking mandates. The most important topic to consider is the fair balancing of interests of the person concerned, the delegate and communication partners, since they may have different and even conflicting objectives. Necessary are both transparency for all relevant activities, in particular on the actions performed by the delegate on behalf of the person, and sufficient control options by the person concerned or, especially when the person concerned cannot handle it on her own, specifically foreseen delegation supervisors [18].

[1] In this setting, the persons concerned are not necessarily “users” in the literal sense of using the FutureID system via the FutureID client themselves, but this activity may be limited to their delegates.

6 Assistive technology

This is more of a list of different assistive technology that is available to people now and that it might be useful to have all project partners be aware of. This list is not exhaustive, but illustrative.

6.1 Alternative output

Most people that use a computer or mobile devices get the majority of their output displayed on screens[2]. If someone has vision impairment, this can be difficult to get this information. The following subsubsections present examples of different types of assistive technology that can help someone with vision impairment. This includes screen readers, screen magnifiers, and Braille displays. People with vision impairment may use one or more of these pieces of technology together (the combination of a Braille display and a screen reader is very common, but if the person can't read Braille, that person will rely solely on the screen reader).

6.1.1 Screen readers and Braille displays

A screen reader is an assistive technology that can takes the output on the screen and presents it in other types of modalities, for example as audio or as Braille. Part of the purpose of a screen reader is to help users orient themselves on the screen or in the application; screen readers normally have some kind of cursor that users can use to move around the screen and control what the screen reader is focusing on. Events from the system, such as a pop-up window being shown or a web page being loaded can also affect the focus of the screen readers. Popular screen readers for the PC include: JAWS, ZoomText, SuperNova, NVDA, and VoiceOver.

Screen readers have been available on mobile devices (particularly smart phones) for some time, but they were expensive and required installation. It wasn't until VoiceOver was added to the iPhone in 2009 that there was a push to make them as standard features on a device. Currently, both iOS (VoiceOver) and Android (Talkback) offer a screen reader on their phones and tablets, and developers are encouraged to make their apps compatible with the screen readers. Making mobile apps compatible with the screen readers on these devices is probably more straightforward than for desktop applications as the software frameworks had accessibility from the beginning instead of being added in later.

Refreshable Braille displays work in concert with the screen readers. They are special pieces of hardware that can raise and lower small bits of a matrix to form Braille letters. If users can read Braille this is a great way of reading text on the screen and can free up the audio channel. For example, a presenter may use a Braille display for speaker notes while giving a presentation (instead of having them read aloud).

[2] Ironically, for sound output there is usually some sort of contingency made for someone not hearing that output.

One thing to keep in mind with screen readers is that they are very complex. While a developer may be able to sit down and learn the basics of navigating and using a screen reader, it is nothing like someone who is dependent on the screen reader and must use it every day as the only way for access. Developers can simulate the effect partially by covering their display, but at the end of the day they can always look if things go wrong. It is important that developers understand how a screen reader works, but it is not a substitute for testing with real users. Testing also applies for Braille displays, especially since most developers cannot read Braille.

6.1.2 Screen magnifiers

A screen magnifier is able to enlarge a portion of the screen for a user. Many operating systems provide some sort of built-in magnification tool, but more fully featured magnifiers are available. This includes features like different levels of magnification and the ability to only take up a certain amount of screen space. Some newer screen magnifiers can also re-render text at the magnified level to make it more crisp and legible. Popular screen magnifiers on the PC include: SuperNova, Virtual Magnifying Glass, and ZoomText.

The latest versions of iOS and Android provide built in screen magnifiers as well. Given that they have a smaller screen to work with, their do not have all the bells and whistles of the desktop versions, but the high resolution screens can help make up for blurry images that happens on desktop magnification.

Finally, it is worth noting that magnification of the screen is not the only way to make text bigger. Most operating systems offer some ability to change the font size that is presented to the user for labels and button text in a user interface. Some operating systems also allow users to enlarge the whole UI. Running the screen in lower resolutions also provides another way of enlarging the screen.

6.2 Alternative input

Most input with computers and mobile devices go through our hands, be it typing a keyboard, moving and clicking with a mouse, or touching directly on the screen. This can be difficult for people with disabilities that prevent them from using their hands. The following subsections provide examples of assistive Technology that can help people provide input to a device. Most of these devices base themselves on current metaphors for entering information. That is, they mimic a keyboard, mouse, both a keyboard and mouse, or integrate with another system that allows input into the system.

6.2.1 Head mice

A head mouse is a hands-free way of interacting with the mouse cursor on a PC[3]. It allows people that can control the movement of their head to interact with a standard PC. The head

[3] Here, PC is being used in the generic sense to mean any computer (desktop or notebook) running a desktop operating system (Mac or Windows).

mouse consists of a web cam that is mounted on the PC. This camera will look for a specific point—normally a silver dot that can be placed on the forehead or a hat—and use that for computing the cursor's position. Using head movements, the person can move the mouse cursor around the screen. All of this translation is handled via the camera: the PC only sees a normal mouse.

6.2.2 Onscreen keyboard and mice

Normally, head mice or switches are combined with some sort of onscreen keyboard to provide text input to the PC. People using tablet PCs or other touchscreen devices normally use an onscreen keyboard as well. An onscreen keyboard is simply a program that shows a keyboard on screen and allows entry of keys by using a pointing device. While most systems provide a built-in onscreen keyboard, they normally have a very limited feature set. There are versions that are targeted for people with movement disabilities—for example, KeyStrokes, Florence Virtual Keyboard, SofType, Magic Cursor 2000, or Click-N-Type, that provide a much better input experience with shortcuts, alternate layouts, keystroke prediction, and other features.

If the person cannot otherwise click a mouse button, software—such as DwellClick, Dwell Clicker 2 or Magic Cursor 2000—can be installed so that resting the cursor in a position will start a timer and after certain time, a click will be sent using the current cursor position to the PC. Different types of clicks can be toggled in the software.

6.2.3 Switches

Switches provide a way for interacting with a PC with limited movement. The switch can be activated by a number of means, including a push button or a puff and sip mouth tube. The switch then translates this to an action on the PC or mobile device. Depending on the capabilities of the person, multiple switches may be employed together.

For accessing general applications, there usually is some software installed on the system that helps in this process. To use one switch as an example, the software could scan from the top to the bottom of the screen with a giant line until the switch is triggered. Then, the line would stop at that position and a new line would show up looking from left to right. When the switch is triggered again, that line would stop and the software would send a click to the point where the two lines intersect. Usually an onscreen keyboard can be used in conjunction with the switch to input text.

6.2.4 Speech recognition

Speech recognition is a technology where speech is taken and converted into either text or commands. The Dragon family of products from Nuance is well known for its voice dictation software, but this software also allows users to move the mouse, run certain programs, and control various parts of a PC. Developers can also use the Nuance's SDK to customize Dragon to work with their applications.

Recently, mobile operating systems have gotten sophisticated cloud-based speech recognition services (Apple's Siri and Android's Google Now). So far, these services have been re-

stricted to dictation and specific commands like performing web searches, creating reminders, or setting timers. One can hope that developer access to these services is granted beyond the option of using dictation.

One thing to keep in mind with speech recognition is that it currently is only available for the most popular languages. This is because developing a general speech recognition packages is roughly the same amount of work for each language. This naturally leads to only the languages with the most speakers being targeted. This can mean that people wishing to use speech recognition may not be using their native language.

7 Existing work

Different groups have done a lot of work specifying how different technology can be made accessible. This section provides an overview of different guidelines and standards that are available. We also include programming guides for different environments that will be used in the FutureID project. Finally, we also include some information from past and current projects some partners in the project have done on in the area of security and accessibility (specifically accessibility and authentication).

7.1 Standards and guidelines

There are different guidelines and standards for creating accessible products and services. The most relevant ones for this project are probably for the web and smart cards.

7.1.1 Web

As mentioned in § 5.1, the World Wide Web Consortium's Web Accessibility Initiative (W3C WAI) has created several different guidelines concerning accessibility of web content and applications. For FutureID, the most relevant guidelines are WCAG 2.0 and WAI-ARIA.

7.1.1.1 Web Content Accessibility Guidelines (WCAG)

The WCAG lay out guidelines for how content can be made accessible. There have been two revisions of the guidelines. The first version came out in May 1999 and the second version was made a recommendation—the W3C's equivalent of a standard—in December 2008. The W3C points out that it is possible to produce content that follows both sets of guidelines, but strongly recommends to authors only use 2.0. The guidelines are freely accessible from the W3C's website [19].

The WCAG 2.0 is built on four principles: that content should be Perceivable, Operable, Understandable, and Robust. These principles are then codified into 12 different guidelines. Each guideline is then given three different levels of success criteria for each guideline: A (the lowest), AA, and AAA (the highest). The guidelines also include a list of techniques that can be used to help elements reach the higher level of conformance. The different levels of success criteria make it possible to aim for a certain level of conformance for the content. Different countries and organizations have set certain levels of what they expect conformance to be.

Information presented in the WCAG 2.0 tries to be more generic than information in WCAG 1.0. The upshot of this is that the guidelines can be applied in contexts that are beyond the traditional idea of a web browser and web content. Indeed, using the WCAG can be a good starting point when trying to ensure any content is accessible. Another improvement in the WCAG 2.0 compared to version 1.0 was to make things more testable than they were in the first version. This makes it possible to run a webpage through a battery of tests and find out what level of conformance the page has. However, it should not be taken to mean that the page is free of accessibility issues. The W3C Working Group [19] explicitly state that

"…even content that conforms at the highest level (AAA) will not be accessible to individuals with all types, degrees, or combinations of disability, particularly in the cognitive language and learning areas." In addition, Rømen and Svanæs [20] showed that accessibility issues still remained even when a web page had successfully passed all the WCAG tests.

These guidelines address a number of different disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities and comprise an attempt at specifying potential solutions for optimal access to web content. In doing so, they make some specifications regarding potential technical as well as organisational solutions that already provide for a much more useful level of detail than the umbrella legislations within the EU as mentioned in § 5.1. The guidelines are structured into several layers that are meant to enable a specific addressing of a target audience and corresponding accessibility measures tailored to the audience's needs. There are four central principles that define the scope and foundation of the WCAG. Content must be:

- Perceivable
- Operable
- Understandable
- Robust[4]

Under these four principles, 12 guidelines provide basic goals for accessibility [19]:

Perceivable

1. Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.
2. Provide alternatives for time-based media.
3. Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
4. Make it easier for users to see and hear content including separating foreground from background.

Operable

5. Make all functionality available from a keyboard.
6. Provide users enough time to read and use content.
7. Do not design content in a way that is known to cause seizures.
8. Provide ways to help users navigate, find content, and determine where they are.

Understandable

9. Make text content readable and understandable.
10. Make Web pages appear and operate in predictable ways.
11. Help users avoid and correct mistakes.

[4] See the supporting document *Introduction to Understanding WCAG 2.0* [21] for a more detailed explanation of the four principles of accessibility.

Robust

12. Maximize compatibility with current and future user agents, including assistive technologies.

In each of the single guidelines, basic goals are formulated to enable accessibility. These goals offer a general framework and objectives intended to help authors and developers to determine specific measures for accessibility realisation. The description of techniques provides two different types of measures. One type of techniques is a measure identified as sufficient to achieve a certain success criterion. An additional type of techniques is advisory techniques that can enhance accessibility without being a fully sufficient technique. Though advisory techniques are not testable like the sufficient techniques, these are identified being helpful under circumstances, and authors and developers are being encouraged to implement the advisory techniques as well if possible [21].

7.1.1.2 Accessible Rich Internet Applications (ARIA)

Also shaped by the W3C and still in on-going process are the recommendations for Accessible Rich Internet Applications (WAI-ARIA). The ARIA (or WAI-ARIA) is an initiative to create standards to make web content and applications more accessible to people with disabilities with a focus on dynamic content (such as that produced by using technologies like AJAX, DHTML, and JavaScript). While browsers can update parts of their web-pages dynamically, there was no mechanism for sending this information further. Usually, this means that people using a screen reader need to reload the entire page again to get new information, usually having to rediscover their place again [22]. The ARIA attempts to solve this problem by defining ways that browsers can inform assistive technology about these changes. The ARIA presents an ontology of roles, states, and properties that describe different elements on the page to inform the browser and assistive technology how different elements should be treated (for example, as a slider, a item in a tree hierarchy, or a popup) [23]. There are also properties to describe live areas (i.e., areas that are frequently updated) and drag and drop areas.

The ARIA is currently a work in progress. A “candidate recommendation” was released in January 2011 [23]. Since then, work has begun on implementing tests to make sure that browsers can conform to the final 1.0 of ARIA. Yet, developers can began adding ARIA tags to web pages today, and there are implementations in all the modern browsers. ARIA tags will not affect legacy browsers, though Featherstone [24] documents that support in different browsers can be problematic, and Fischer [25] documents a few hurdles that need to be overcome before a 1.0 release. There also are plugins available for content management systems like Drupal that include support for ARIA.

7.2 Programming guides

While programming guides aren’t necessarily an international standard, they include best practices and patterns that developers can follow when developing applications. In this section, we look at some of the relevant programming guides for accessibility for FutureID. There are other guides, for example iOS has its own programming guide for accessibility

[26], but FutureID does not use iOS. Instead, the decision is to use the Android mobile platform and Java for the desktop version.

7.2.1 Android

The majority of the documentation for Android accessibility is on Google's Android developer website (http://developer.android.com). It is divided up into sections depending on where someone is working: designing, developing, or testing. All of the documents end with a checklist that makes it easy to keep the main points in mind.

7.2.1.1 Design guidelines

For designers, Google has included a section about patterns for accessibility in its design guidelines [27]. The guidelines introduce Android's accessibility tools for the most recent versions of Android:

Talkback
A screen reader that is available by default in current versions of Android.

Explore by Touch
A feature that works in combination with Talkback to read the item that is under a user's finger on the touchscreen, it also can be used to control navigation via gestures.

Accessibility Settings
These are options that let you modify the display and sound. This includes changing the size of text and how fast text is read. Version 4.2 also adds a gesture to magnify the screen.

The accessibility guidelines are built around the principle that the users should always know they are. This helps them build a mental model of where they are in an app. The main point here is that if users are using Explore by Touch, they are using the hierarchy and structure that is exposed to Explore by Touch. This structure must be as straightforward as the visual structure. The main guidelines for accessibility are:

Make navigation intuitive
This follows from the principle above. It should not be difficult for someone to navigate through the app and perform actions.

Use recommended touch target sizes
However, they point out that it might be appropriate to make targets larger for those that have manual dexterity issues or children with developing motor skills.

Label visual UI elements meaningfully
This is similar to the use of ALT tags for images in web pages. For Android, this is the contentDescription attribute and helps explain a UI element that is visual only (for example, a button with an image).

Provide alternatives to affordances that time out

The example used in this guideline is controls for a video player. The controls fade out after a set time when a video is playing. The accessibility framework might not notice them before they have faded out. These controls need to be accessible in an alternative way or act differently when accessibility is enabled.

Use standard framework controls or enable TalkBack for custom controls

The controls provided by Android have accessibility support built in and need very few changes (for example, only changing the contentDescription). If someone is creating custom controls, they should be designed with some meaningful interaction with TalkBack in mind. This is detailed more in the developer guide.

Try it out yourself

This last guideline encourages designers to turn on accessibility and try out how well a design works in Android. While a casual knowledge of assistive technology won't catch all issues, it will help make the designer aware and find the most glaring issues.

7.2.1.2 Developer guidelines

The most extensive set of guidelines for accessibility on Android is provided to the developers. This includes an application developer guide [28], an accessibility checklist [29], and guidelines for creating an accessibility service (something like TalkBack and likely not relevant for FutureID). There are also videos available from Google I/O [30], [31], [32] that provide a hands-on approach to implementing accessibility support and some examples of how to interact with TalkBack.

The developer guide divides accessibility work up into four parts:

Label user interface elements

All elements should be labeled appropriately. This is most often necessary for buttons or labels that have an icon, but no text. This is done by setting the android:contentDescription attribute for each view.

Enabling focus navigation

This is something that is more important for earlier versions of Android prior to 4.0 and Explore by Touch. The guide outlines the different attributes or function calls one can use to control the order of navigation when using something like a directional controller (e.g., the trackball or direction keys on a keyboard).

Building Accessible Views

While using standard controls simplifies accessibility work, there is some point when a developer needs to create a custom view to accomplish a task. This requires handling clicks from a directional controller and notifying the accessibility service of changes in the view's state. This is accomplished by first, signaling that an AccessibilityEvent needs to be sent and then, populating the event that is sent. Other tasks may include recognizing gestures or providing a customized accessibil-

ity context (for example, a calendar view with a context for each day). Most of the documentation here describes how to handle changes between different versions of Android.

The final part of the document encourages testing of the application. Guidelines for testing are discussed in the next section.

The developer checklist describes requirements that are needed to be in place to ensure a minimum level of accessibility and then some recommendations to increase the user experience of an app when using accessibility. Most of this information is presented in both the developer and designer guidelines, but is codified into steps. The final set of the checklist describes special cases and considerations that should be accounted for. This section is a grab bag of different situations that may apply to a specific app. If any of these apply, there is a short recipe of how it should be taken care of. The checklist provides a good way of operationalizing the information that was provided in the developer guide.

Of course, developers should also make themselves familiar with the Accessibility API documentation. Due to the nature of web documents, getting to the documentation for a specific attribute or method call is only a click away from the developer guidelines.

7.2.1.3 Testing guidelines

The testing guidelines [33] are presented in the form of a checklist for goals, requirements, recommendations, special cases and considerations, and how to test accessibility features. The document describes how to test an application with TalkBack, Explore by Touch, focus navigation, and gesture navigation. This information is useful for *anyone* that wants to start testing accessibility on Android quickly.

The high level goals for testing should be the following:

- Set up and use the application without sighted assistance
- All task workflows in the application can be easily navigated using directional controls and provide clear and appropriate feedback

The document then provides lists tests that are *required* to pass to provide a minimum level of accessibility. This includes making sure that the different assistive technology on the device works with the app. There are also tests that are *recommended* to pass to ensure a high quality experience when people are using the application. This includes making sure that the prompts provided for audio are not repetitive and that the amount of prompting is sufficient. It also asks that testers review the special cases and considerations that developers made when creating the applications (see previous section), make sure that controls that change function (e.g., a play and pause button) give an appropriate feedback. The document also asks for testers to verify that video playback support captions or subtitles.

7.2.2 Java

Since it seems that anything implemented on the desktop for FutureID will be using the Java programming language, there are also some guidelines for writing accessible applications with Java. There are two documents that can be looked at. One is by Oracle [34] (the current owners of Java) and the other is by IBM [35]. Again, there are also documents about how to create assistive technology, but we will focus on the programming guides. Though the accessibility support has been improved, the majority of the work has been available since Java version 1.2 (Java 2).

The guide from Oracle offers a very general overview over the accessibility API and mostly points at the reference documentation for the Java Accessibility (javax.accessibility). The main takeaway is to use the infrastructure that is provided by the Java Foundation Classes (JFC also called “Swing”). More details about making an application accessible are included via a Swing tutorial [36]. The tutorial details on making a custom panel accessible, adding extra information to current panels and using the Java Monkey accessibility tool.

The guide from IBM covers some of the same information that was discussed by Oracle, but goes more in depth with a section entitled “essential accessibility programming practices” that many techniques for accessibility programming and includes ways that these can be tested to see if they follow. The work that was shown in Oracle’s Swing tutorial is then expanded on with even more documentation and examples. It is probably best to look at the Oracle tutorial first, and then read IBM’s document for a more thorough version, including a different set of documentation to the same javax.accessibility package. IBM’s guide ends with a section on testing applications for accessibility (along with an appropriate checklist [37]) and encourages that the documentation for the application is also accessible.

Both documents strongly encourage that developers use the JFC classes when creating controls and not to use the older abstract windowing toolkit (AWT) controls. This is because those controls were never designed to be accessible. There is also IBM’s Standard Widget Toolkit (SWT), which provides Java bindings to native controls and is used for its Eclipse platform. Since 2010, the SWT has built in support for the IAccessible2 API. IAccessible2 is a bridging API that attempts to fill perceived gaps in Microsoft’s Active Accessibility API. However, developers using SWT will not need to program directly to the API. Instead, SWT has added extra properties and relations to communicate with IAccessible2. IBM has provided a note [38] that includes some code examples and links to the AccProbe tool for testing and debugging IAccessible2 interfaces.

There is an additional document, but that explains more about how to make sure that the Java accessibility bridge connects up with the assistive technology in Windows.

7.3 Partner projects

This section will review some projects from partners in the FutureID project that could be relevant for the accessibility work in the FutureID project. Again, this is not an exhaustive list,

but should give an example of some of the areas of expertise partners have in the area of accessibility and security.

7.3.1 Inclusive authentication

NRS has taken a look at different authentication methods and how these can cause problems for users with disabilities. The main reason for looking at authentication was that, in the mid-2000s, the helpdesk for a web service had one third of their phone calls from people having problems logging in to the service. This service provides access to forms and services in Norway and it is expected that everyone in Norway will need to use this service (especially for help in filing personal tax returns). It is important to make sure that the correct person logs into the correct account.

Fritsch, Fuglerud, and Solheim [39] argue that there is a strong need to look at the usability and accessibility requirements when designing identity management systems. Included in their work is a review of different authentication methods and what sorts of issues different classes of disabilities have with them. This includes people who are visually impaired, hearing impaired, physically impaired, cognition impaired, or have dyslexia. They point out that there is no one solution that will work for every class of disability. Finally, they champion multimodal interfaces as a way of allowing users to personalize an authentication method to work well for them and to provide the necessary security for the service providers.

7.3.2 E-Me

The e-Me project created a prototype for a social payment application that was connected to an OpenID provider. This provider was designed with the idea of being accessible to as many users as possible and offered different ways for users to authenticate themselves. This included the traditional password and a two-factor method of authentication on a smartphone, but also alternative methods such as recognizing a series of pictures, a series of sounds, drawing a picture, or knowing the answer to several personal questions. The goal was to make authentication easier for everyone, but specifically for users with different cognitive and physical disabilities. The provider also can store information about a user's accessibility preferences and forward that to the banking application if it is supported and desired. This required looking at the requirements for storing this information and exchanging that with another application.

Røssvoll and Fritsch [40] describe the authentication methods and some results based on a user evaluation held with eight participants that were mostly elderly with some participants have dyslexia and some having impaired vision. Those with vision impairment liked the image matching for authentication, while others preferred the familiar password-based version. Some of the vision-impaired individuals tried the pattern matching, but felt it was not accessible for them. None of the users checked their privacy settings, so it was important that good defaults were chosen. Røssvoll and Fritsch [41] also describe the design decisions for accessibility, information security, and privacy that went into making the prototype.

7.3.3 uTRUSTit

The uTRUSTit project looked at trust issues in the Internet of Things. Specifically, users used a Trust Feedback Toolkit (TFT) to determine whether or not they should trust an object that was connected to the Internet of Things. One of the objectives of the projects was to ensure that the prototypes were accessible to people with vision impairment and dyslexia. The prototypes used different versions of Android. Time was spent making sure that the different apps worked with Talkback and that the text was easily understandable. Then, this spring, participants with different levels of vision impairment to evaluated the prototypes in scenarios.

Talkback and Android matured a lot over this time, and the project saw the best results for controlling the interface and understanding the information presented by the TFT when the latest versions were used. Yet, because of requirements for building prototypes, it was not possible to change the version of Android that was running on the different prototypes. This resulted in different versions of Talkback with different capabilities for each device and required a bit of instruction for people that needed to use Talkback. Some participants had impaired vision, but preferred to use a magnifying glass to help enlarge text. It was a low-tech solution that worked. More details in an upcoming report due in August.

Some guidelines for the user interface and accessibility were put together in a report [42] after the first round of evaluations. The guidelines are currently being updated and should be released later this year. They will be based on the evaluations that were run in spring.

8 Requirements

This section lists the accessibility requirements for FutureID. All requirements are prefixed with a unique ID of the following form:

AIR-*xx*

Where *xx* is a digit. The digits may have additional numbers. These numbers indicate that they are children of the main requirement and must be fulfilled so that the main requirement can be fulfilled (e.g., Requirement AIR–01.1 must be met if requirement AIR–01 is to be met). This is to help make it possible to uniquely refer to a requirement in other documents.

All requirements are phrased using the keywords that are defined in RFC 2119 [43] for indicating requirement levels.

8.1 Perspective and focus of this section

The focus of this deliverable is the end user. Consequently, the requirements below address specifically the accessibility for end-users and *not* e.g., an accessible, user-friendly administration interface for administrators of the *FutureID core services*. FutureID core services are to be understood as the FutureID user client and the FutureID infrastructure including the FutureID Federation Services, the Credential Verifier, the Broker, and a Trust Service with the trust repository, and additional organizational measures.

8.2 System boundaries and interfaces

The system components Client, Broker, Credential Verifier, Trust Repository, and Application Integration Service determine the system boundaries of the FutureID system and thus also the boundaries of the accessibility and inclusion considerations. On the other hand, this system architecture also determines the components that are outside the FutureID boundaries, namely:

- the eID token hardware,
- the client hardware platform and software environment,
- the server and software infrastructure of the service provider that requests eID services from the FutureID infrastructure, and
- the server and software infrastructure of an external identity provider or external identity broker (e.g. STORK, epSOS, PEPPOL, eSens).

As explained in § 1.1, while the FutureID infrastructure has external interfaces to these components, their provisions for accessibility and inclusion cannot be directly controlled by the FutureID services. It has to be assumed that these components are accessible and inclusively designed.

8.3 Assumptions

The following assumptions are made concerning FutureID components:

Client
The client platform supports assistive technology. Necessary interfaces to assistive technology are provided within the user's domain.

Provider
The service provider implements accessibility and inclusion standards and protocols.

Personnel
The FutureID backend infrastructure is operated by personnel and system administrators with accessibility and inclusion awareness and expertise.

This also leads to the first requirement.

No.	AIR–01 — Accessibility and inclusion for all FutureID services
Description	All FutureID services SHOULD take into account the following accessibility and inclusion requirements. The provision of any accessibility and inclusion functionalities for the FutureID services SHOULD be possible either directly or by open interfaces enabling adequate add-on services by third parties.

8.4 Content and presentation

These requirements deal with presentation of material in the client. In general, all the items in this section that are specified as children are *complementary* to the main requirement. That is, they specify information detailed in the WCAG 2.0 [19] and are either *stricter* than the WCAG 2.0 or *repeated* here for convenience. In cases where there is a contradiction, the requirements specified here take precedence.

No.	AIR–02 — Ensure content in the client is accessible to the largest audience
Description	All content MUST conform to the Level AAA of the WCAG 2.0 [19]. Many of the items are repeated here, but check the guidelines for more information.

No.	AIR–02.1 — Color contrast for text and background
Description	Text MUST have an acceptable contrast to be read by the largest amount of people.

No.	AIR–02.1.1 — Minimum color contrast for large text and background
Description	Text larger than 4.9 mm MUST have a color contrast ratio of at least 4.5:1.

No.	AIR–02.1.2 — Minimum color contrast for smaller text and background
Description	Text smaller than 4.9 mm MUST have a color contrast ratio of at least 7:1.

No.	AIR–02.1.3 — Contrast exceptions for incidental text and logos
Description	Incidental text or logos MAY ignore the contrast ratio requirements.

No.	AIR–02.2 — Typefaces and fonts
Description	Bizarre and indistinct typefaces SHOULD be avoided [44]. Most typefaces in common use are legible.

No.	AIR–02.3 — Default text size
Description	Text MUST respect the default sizes of the operating system, but MAY be larger.

No.	AIR–02.4 — Adjustable text size
Description	Text SHOULD be adjustable to larger or smaller size, either through the operating system, assistive technology, or via mechanisms in the program itself.

No.	AIR–02.5 — Block text readability
Description	Blocks of text MUST be readable by the largest amount of people.

No.	AIR–02.5.1 — Line spacing (leading)
Description	The height of the line SHOULD be at least one and a half times the point size of the typeface being used. It MUST be larger than one and one quarter times the point size. It MUST NOT be more than one and three quarters times the point size.

No.	AIR–02.5.2 — Paragraph Spacing
Description	Spacing between paragraphs SHOULD be at least one and a half times larger than the line spacing. It MUST NOT be smaller than half the point size of the typeface.

No.	AIR–02.5.3 — Line Width
Description	The line width in a block of text SHOULD NOT exceed 70 characters. It MUST NOT exceed 100 characters.

No.	AIR–02.5.4 — Text Alignment
Description	Blocks of text MUST NOT be fully justified. It MUST be either aligned to the left or right margin. Centered text is also allowed, but SHOULD be used sparingly.

No.	AIR–02.6 — Internationalization and localization support
Description	The client MUST be able to be translated into multiple languages.

No.	AIR–02.6.1 — Example translations
Description	Translations of the client SHOULD be provided for in at least three languages (e.g., English, German, and Spanish) to prove that translation is possible.

No.	AIR–02.6.2 — Alternate languages
Description	Translations of the client MAY be provided in French, Italian, or other languages that are in use among the project partners.

No.	AIR–02.7 — Text alternatives for non-textual content
Description	All non-textual content (e.g., images) MUST have alternative text to describe them.

No.	AIR–02.7.1 — Non-textual decoration, formatting, and invisible content
Description	Non-textual content that is used only as decoration, to format items visually, or is invisible to the user MUST be implemented in a way that it is ignored by assistive technology.

No.	AIR–02.7.2 — Non-textual controls
Description	Non-text controls MUST have a name that describes their purposes. See § 8.5 for more information about controls.

No.	AIR–02.7.3 — Non-textual tests
Description	Non-text content tests that would be invalid if given a text alternative MUST have descriptive identifying text instead.

No.	AIR–02.8 — Multiple cues to convey important information
Description	Important information SHOULD be conveyed by more than one type of cue (e.g., not only color, not only text, or not only sound). Use additional information, such as position, or animation, to help convey the information.

No.	AIR–02.9 — Time-based media accessibility
Description	Time-based media (e.g., video and audio) MUST conform to the AAA Level in the WCAG 2.0 [19].

No.	AIR–02.9.1 — Prerecorded audio accessibility
Description	Prerecorded audio tracks MUST be captioned and provide a sign language interpretation.

No.	AIR–02.9.2 — Prerecorded video accessibility
Description	Prerecorded video tracks MUST provide an audio description and an extended audio description where there are not significant pauses to provide normal audio description.

No.	AIR–02.9.3 — Alternative media
Description	Alternative media MUST be provided prerecorded synchronized media or prerecorded video-only (i.e., video, but no audio) content, and live audio-only content.

8.5 Control and Operation of the User Interface

These requirements specify requirements that ensure the client is accessible with different assistive technology, and that people can use the client efficiently and effectively with the assistive technology. Some requirements are based on the Level AAA of the WCAG 2.0 [19].

No.	AIR–03 — Compatibility with Assistive Technology
Description	The client MUST be usable with different types of assistive technology.

No.	AIR–03.1 — Compatibility with screen readers
Description	The client MUST be compatible with at least two of the following screen readers: Talkback, VoiceOver, NVDA, Jaws, Windows Eyes, SuperNova, Orca, ZoomText, or any other equivalent screen reader software.

No.	AIR–03.2 — Compatibility with screen magnifiers
Description	The client MUST be compatible with the at least two of the following screen magnifiers: SuperNova, Virtual Magnifying Glass, ZoomText, any of the operating system specific magnifying tools, or other equivalent screen magnifying software.

No.	AIR–03.3 — Compatibility with onscreen keyboards
Description	The client MUST be compatible with the at least two of the following onscreen keyboards: KeyStrokes, Florence Virtual Keyboard, SofType, Magic Cursor 2000, Click-N-Type, any of the operating system specific onscreen keyboards, or other equivalent onscreen keyboard software.

No.	AIR–04 — Keyboard Control
Description	All tasks in the client MUST have equivalent ways they can be accomplished by only using the keyboard, without requiring specific timings for specific keystrokes.

No.	AIR–04.1 — Logical navigation via keyboard
Description	Navigation using only the keyboard SHOULD be logical. That is, the navigation should follow the logical layout of the client.

No.	AIR–04.2 — Shortcuts for keyboard navigation
Description	Shortcuts to aid navigation MAY be implemented.

No.	AIR–05 — No Timing of essential events or activities
Description	Any activity in the client that is essential, i.e., if removed would fundamentally change information or functionality **and** cannot be achieved in another way, MUST NOT be timed. Exceptions exist for non-interactive synchronized media, events that happen in real-time, and lifetime of tokens and sessions.

No.	AIR–06 — Postponing Interruptions
Description	It MUST be possible to postpone interruptions unless the interruption involves an emergency.

8.6 Legal requirements

This section specifies legal requirements on European level for the provision of accessibility and inclusion features within the context of FutureID core services. Not included are the eID systems and the Service Providers Parties' infrastructures for the requirements listed below. However, accessibility and inclusion functionalities from these sides are assumed to be compliant with national and international standards in the field for the purpose of this report.

Data mentioned in the requirements below and relevant for accessibility and inclusion functionalities are to be understood as "accessibility-and-inclusion-specific data." Such accessibility-and-inclusion-specific data may be personal data of user's concerning their specific needs for accessibility (e.g. the diagnosis about physical or cognitive conditions as sensitive data in the sense of the European Data Protection Directive 95/46/EC), or configuration data

for the settings of the system (from which medical information may be guessed or derived). Accessibility-and-inclusion-specific data must be distinguished from "usability-specific configuration data," which is to be understood as data relevant to provide convenience features and not as an enabling factor for the service access itself. For other personal data and related requirements see in particular D22.6 Analysis of Legal Requirements.

No.	AIR–07 — Compliance with legal requirements for accessibility and inclusion
Description	The provision of accessibility and inclusion features within FutureID services MUST be in compliance with the applicable European legislation relevant for accessibility and inclusion matters. The provision of accessibility and inclusion functionalities within FutureID services SHOULD be in compliance with the UNO Convention on the Rights of Persons with Disabilities and its Optional Protocol.

No.	AIR–07.1 — Data processing legally compliant with European Data Protection Legislation
Description	If accessibility and inclusion functionalities require information about the user's physical or cognitive condition, it MUST be in accordance with the provisions of the European data protection law, in particular the European Data Protection Directive 95/46 EC and the e-Privacy Directive 2002/58/EC and its amending Directive 2009/136/EC (see also D22.6 for details).

No.	AIR–07.1.1 — Avoid the collection and processing of user data
Description	If possible, accessible and inclusion functionalities SHOULD NOT by default require the collection of personal data of the user.

No.	AIR–07.1.2 — Have legal ground for processing personal data
Description	If accessibility and inclusion functionalities require information about the user's physical or cognitive condition, a valid legal ground in accordance with Article 7 European Data Protection Directive 95/46/EC MUST exist (e.g., valid consent, contract).

No.	AIR–07.1.3 — Data collection & processing only as far a necessary
Description	If an independent third party entity offers the accessibility and inclusion functionalities and this requires information about the user's physical or cognitive condition, the service provider MUST NOT obtain this information.

No.	AIR–07.1.4 — Purpose-bound processing
Description	Personal data collected for the provision of accessibility and inclusion functionalities MUST NOT be used for other purposes without legal ground.

No.	AIR–07.1.5 — Deletion of user data if no longer necessary
Description	If accessibility and inclusion functionalities require information about the user's physical or cognitive condition, the personal data about the user MUST be deleted once it is no longer necessary for this purpose.

No.	AIR–07.1.6 — Appropriate safeguards for user data
Description	If accessibility and inclusion functionalities require information about the user's physical or cognitive condition, appropriate safeguards MUST be implemented to protect that data (technical and organizational measures). Moreover, this data SHOULD be stored under the control of the user (e.g., locally on the user's device).

No.	AIR–07.2 — Realize transparency and user control
Description	Sufficient transparency and appropriate ways for users to exercise control MUST be provided, while these SHOULD take into account specific accessibility and inclusion needs of users. Each legal ground for the collection and processing of personal data for the purpose of providing accessibility and inclusion functionalities MUST be made available for the user at any time, while different levels of user abilities regarding perception and understanding of all information relevant to them SHOULD be taken into account. For privacy-related requirements, an example is given as follows (see also D22.3): To enable impaired users for giving valid, informed and voluntary consent to the processing of their data, information about the nature of the service, the modus of processing, and the implemented technical and organizational measures MUST be given at an utmost early stage of the interaction in accessible formats. The information of the user SHOULD comply with the layered policy approach as proposed by the Article 29 Working Party in its Opinion 10/2004 on More Harmonised Information Provisions (WP100).

No.	AIR–07.2.1 — Enable information on user side
Description	Accessibility and inclusion functionalities MUST include functionality for the user to learn all relevant information concerning the user at any time, e.g., the price of the service, legal protection, which data is collected, processed and stored. Also, each legal ground for the collection and processing of personal data for the purpose of providing accessibility and inclusion functionalities MUST be made available for the user at any time, taking into account different levels of user abilities regarding perception and understanding of all information relevant to them. For privacy-related requirements, an example is given as follows (see also D22.3): To enable impaired users for giving valid, informed and voluntary consent to the processing of their data, information about the nature of the service, the modi of processing, and the implemented technical and organizational measures MUST be given at an utmost early stage of the interaction in accessible formats. The information of the user SHOULD comply with the layered policy approach as proposed by the Article 29 Working Party in its Opinion 10/2004 on More Harmonised Information Provisions (WP100).

No.	AIR–07.2.2 — Enable control on user side
Description	Accessibility and inclusion functionalities of FutureID services MUST include functionality for the user to exercise control about her data by exerting influence or by decisions, e.g., through controls built into the UI so the user can act if information is false or the user wants it deleted.

No.	AIR–07.2.3 — Allow alternative output
Description	Accessibility and inclusion functionalities SHOULD allow alternative outputs other than just a user computer. This output SHOULD include alternate devices (e. g. tablets and smartphones) as well as output channels to assistants of the user (e. g. delegates, caring persons, and other authorized third parties). More examples are: Accessibility and inclusion functionalities SHOULD allow alternative access systems to just screen (e. g. ASCII-export for text-to-voice readers). Accessibility and inclusion functionalities SHOULD allow the semantically equivalent and lossless processing of alternative access systems (e. g. checking or creating signature components), especially if they are used to exercise legally binding or else highly relevant decisions.

No.	AIR–07.2.4 — Implement feedback and help channels
Description	Accessibility and inclusion functionalities MUST include the implementation of assistive feedback and help channels (multiple channels) to enable the user to handle an error message or other accessibility dysfunction. This includes a contact channel to an external support person on the side of the entity providing the accessibility services. See also §§ 8.5 and 8.8.

No.	AIR–07.2.5 — Logging of processing operations
Description	Any changes to the data set (collection, modification, backup, deletion, etc.), as well as read-only accesses MAY be logged and stored under the control of the user (e.g., locally on the user device powered by the user client). Accessibility and inclusion functionalities then MUST include functionality for the user to have reading access to these logs.

No.	AIR–07.3 — Support of service providers offering accessibility functionalities
Description	Service Providers SHOULD be supported in choosing eID services that fulfill accessibility and inclusion requirements (e.g. by providing information such as “accessibility & inclusion seals” within the FutureID infrastructure). Such support MAY be realized by holding this information in the trust repository.

8.7 Testing

This section specifies requirements for testing the accessibility of the client. While the requirements above are necessary to make the client accessible, they are not sufficient.

No.	AIR–08 — Testing the accessibility of the client
Description	The accessibility of the client MUST be tested.

No.	AIR–08.1 — Expert testing of accessibility of the client
Description	The client accessibility SHOULD be tested by experts in accessibility who understand how assistive technology is used and how the client will be used.

No.	AIR–08.2 — User testing of accessibility of the client
Description	The accessibility of the client MUST be tested by users with disabilities.

No.	AIR–08.2.1 — Testing of client with people with vision impairment
Description	The client SHOULD be tested by users that have vision impairment.

No.	AIR–08.2.2 — Testing of client by people with motor impairments
Description	The client SHOULD be tested by users that have motor impairments.

No.	AIR–08.2.3 — Testing of client by people with hearing impairment
Description	The client SHOULD be tested by users with hearing impairment.

No.	AIR–08.2.4 — Testing of client with people with dyslexia
Description	The client SHOULD be tested by users that have dyslexia.

No.	AIR–08.2.5 — Testing of client with people with other cognitive impairments
Description	The client SHOULD be tested by users with other cognitive impairments, such as memory problems or mental retardation.

8.8 Help and Support

This section covers requirements that deal with help and support services for people using the client.

No.	AIR–09 — Client help and support material accessibility
Description	Online help material—such as web pages, digital manuals, or local on the machine running the client—MUST be accessible as per AIR–02 — Ensure content in the client is accessible to the largest audience.

No.	AIR–10 — Alternative help and support
Description	Alternate help and support systems for the client (e.g., call centers, learning centers) SHOULD take accessibility and universal design into account.

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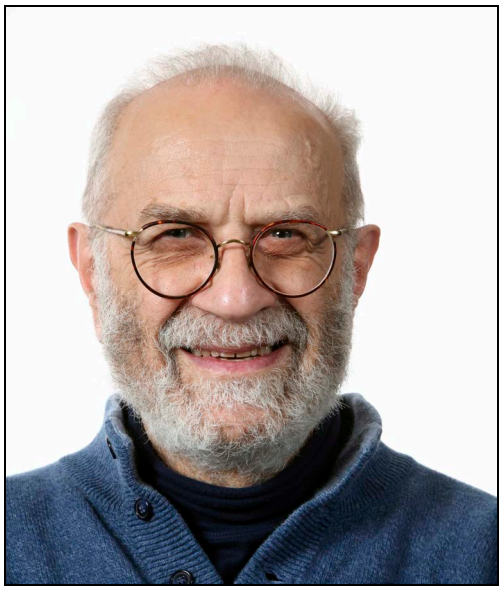
A. Personas

The sections below introduce us to two additional personas that can be used for designing the interface for the client. These personas neither cover every disability, nor every aspect of the disabilities they have, but they should help keep the needs of these users in mind. The format is the same that was used for D34.1.

A.1 Professor Friedhelm Krüger



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Friedhelm is a 67-year-old professor of mathematics at the University of Nürnberg. Friedhelm enjoys his job as a professor and finds he traveling to present papers at conferences, run summer schools, or participate in EU projects. Though he is getting older, he does not want to stop working as a professor and hopes that he can continue in an emeritus capacity at the university. When he is not at work and even though he needs a cane to get around, he can be found out on his sailboat, traveling to different areas of Europe to sample the fishing in the area.

Motivation to use FutureID: The Professor's work requires him to log in to many different networks at different schools, conference centers, and other places. This requires a bit of different ways of authenticating. He likes the idea of having an ID that can be used in multiple places instead of having to get something new every time. He also hopes that it has big enough type for him to read.

Attitude towards private date usage: Professor Friedhelm is generally concerned about private data. He is normally distrustful of new technology. Preferring to join in once others have solved most of the problems (and can answer his questions).

Attitudes	Yes	Partially	No
If I have the opportunity to do something digitally, I generally prefer it			X
I am interested in new ICT innovations and products		X	
I am often being asked for guidance regarding computer problems, buying advice etc.			X
Computer- / Internet knowledge is an important skill in almost all professions	X		
We have to care more (be more concerned) about privacy in general		X	
I don't know much about computers, therefore I have fear using them		X	
I try to avoid technical things		X	

Basic Knowledge about	
Programs / Applications	X
Operating System	X
Data Backup / Protection	X
E-Mail	X
Homepages / Websites	X
Firewall	
Chat	
Blogs	X
IP-Adresses	
Router	
Viruses, Trojans	
Anti-Virus-Software	
Encryption	
Password protection	
Security Updates	
Tracking Cookies	X

Skillset	
Using a search engine	X
Text processing	X
Installing Software	
Creating Presentations	X
Spreadsheet Program (Excel)	X

Software /Service Usage	Type	Usage Frequency
E-Mail	X	Daily
Online Shopping	X	Quarterly
Online Banking	X	Weekly
Paypal (or similar service)	X	Quarterly
File-sharing software		
Own Homepage	X	Yearly
Facebook Account		
LinkedIn Account	X	Rarely

Device Type	at Home	at Work
Desktop PC	X	X
Laptop		X
Printer		X
Digital Camera		
Scanner		X
WebCam		
Portable Music Player		
Smart Phone		X
Tablet		
DSL Internet Access	X	
Mobile Internet	X	X
External Card Reader	X	X
Laptop integration		

eID Cards	Type	Usage Frequency and Type of Usage
Passport	X	Frequently, when travelling / 1× every 2 to 3 months
Identity Card	X	Seldom, for public controls / 1× year
Bank Card	X	Frequently for ATMs or online banking, 2× a month
Health Card	X	Frequently, once a week
PKI-Card	X	Almost every day: When being at work or when working from home or travelling

A.2 Jose Salazar

Jose is a 28-year-old engineer in the auto industry. He helps with sourcing parts, which means that he can represent his company in different agreements that they have. This naturally results in lots of travel for Jose—something that affects his social life quite a bit, especially when he tries to find dates. However, he sometimes is able to combine a business trip with a visit to a unique ski location in winter or fishing in the summer.

Motivation to use FutureID: Jose would be interested in trying out some sort of system that would make it easier to digitally sign documents. He wouldn't mind having to have multiple different logins (with the passwords that follow). Jose has dyslexia and has trouble writing different passwords correctly; there is always one or two symbols that get mixed up. He also uses a screen reader to help him read long bodies of text and is happy when new technology also works with it.

Attitude towards private date usage: Jose is concerned about privacy issues, especially in terms of the company that he works for. He would like to know, but usually finds all the documents so full of legal mumbo-jumbo that he doesn't bother to look at them and hopes someone else has taken a look at things and sorted them out before he has to use them.

Attitudes	Yes	Partially	No
If I have the opportunity to do something digitally, I generally prefer it		X	
I am interested in new ICT innovations and products		X	
I am often being asked for guidance regarding computer problems, buying advice etc.		X	
Computer- / Internet knowledge is an important skill in almost all professions	X		
We have to care more (be more concerned) about privacy in general		X	
I don't know much about computers, therefore I have fear using them		X	
I try to avoid technical things			X

Basic Knowledge about	
Programs / Applications	X
Operating System	X
Data Backup / Protection	X
E-Mail	X
Homepages / Websites	X
Firewall	X
Chat	X
Blogs	X
IP-Adresses	
Router	
Viruses, Trojans	
Anti-Virus-Software	
Encryption	X
Password protection	X
Security Updates	X
Tracking Cookies	X

Skillset	
Using a search engine	X
Text processing	X
Installing Software	
Creating Presentations	X
Spreadsheet Program (Excel)	X

Software /Service Usage	Type	Usage Frequency
E-Mail	X	Daily
Online Shopping	X	Monthly
Online Banking	X	Weekly
Paypal (or similar service)	X	Monthly
File-sharing software		
Own Homepage		
Facebook Account	X	Daily
LinkedIn Account	X	Frequently

Device Type	at Home	at Work
Desktop PC		
Laptop	X	X
Printer	X	X
Digital Camera	X	
Scanner		X
WebCam	X	
Portable Music Player	X	
Smart Phone	X	X
Tablet		
DSL Internet Access	X	
Mobile Internet	X	X
External Card Reader	X	X
Laptop integration		

eID Cards	Type	Usage Frequency and Type of Usage
Passport	X	Frequently, when travelling / 2× month
Identity Card	X	Seldom, for public controls / 1× year
Bank Card	X	Frequently for ATMs or online banking
Health Card	X	Seldom, once a year
PKI-Card	X	Almost every day: When being at work, or when working from home or travelling