hcim
Human-Computer Interaction and Multimedia

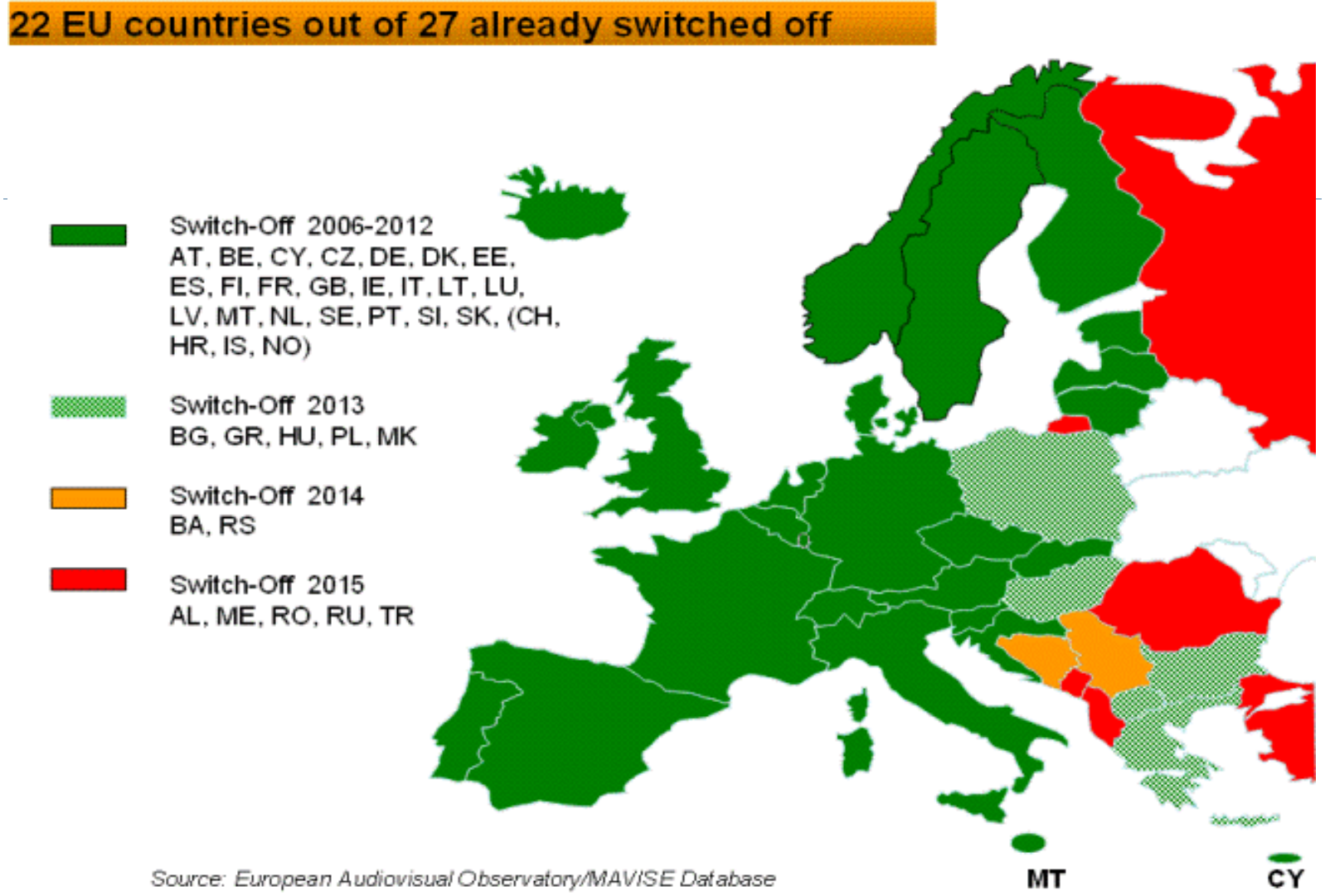
Understanding the Accessibility barriers of the Blind when interacting with TV

Daniel Costa

Outline

- Motivation
- Goals
- Related work
  - TV platforms
  - Existent guidelines and recommendations
  - Assistive technologies
- Current state of accessibility
  - Survey (results and discussion)
  - Automated and Manual evaluation (results and discussion)
- Brainstorming: Finding a solution

Motivation



- Digital TV switchover around the world
  - Better sound and image, interactivity, audio description, etc.

Motivation

- The use of Connected TVs is increasing
  - Applications, Web browsing, etc.

Motivation

- As this technology becomes common it is paramount that these new features are **accessible** by all.

- TV has been a central part of modern days' culture. **And like everyone else, blind and partially sighted people want to watch TV and be part of that culture** – European Blind Union

Goals

- Characterize and address Connected TV's accessibility problems, with a special emphasis on visually impaired users.

- Explore the increasing trend of integrating mobile devices and TV platforms to propose and validate accessible solutions involving multiple modalities or adaptive interaction in order to increase the accessibility of the resulting TV platform.

Related Work

Framework	Device	Support for TV app development	Programming language used	Runtime Environment
Hybrid Broadcast Broadband TV	STB, TV	Yes – HbbTV specifications, HbbTV test suite (cost 2000€)	HTML, Javascript, CSS	**Browser**
Smart TV Alliance	STB, TV, Mobile device (smartphone or tablet)	Yes – SDK software TV emulators, Multiscreen emulators, Eclipse IDE, self-compliance checking tool for validation	HTML 5, Javascript, CSS	**Browser**
Web4CE (CEA-2014)	STB, TV, Mobile device (smartphone or tablet)	No	CE-HTML (XHTML, Javascript, CSS TV profile)	**Browser**
Roku	STB, TV	Yes – Roku SDK, administration tools	BrightScript	-
Google TV	STB, TV, Mobile device (smarphone or tablet)	Yes – tutorial for android development and TV integration, Google TV emulator	Java	JRE
Opera TV	STB, TV	Yes – Opera Devices SDK, specifications, Opera TV emulator	HTML 5, Javascript, CSS	**Browser**
Frog	STB, TV, Mobile device (smarphone or tablet)	Yes - Source code, documentation	HTML 5, Javascript, CSS	**Browser**
Open TV 5	STB, TV, Mobile device (smarphone or tablet)	Yes – Open TV 5 SDK, javascript framework, documentation	HTML 5, Javascript, CSS	**Browser**
Liberator TV platform	STB, TV	No	-	-
Yahoo! Smart TV	STB, TV	Yes – ADK, documentation, TV emulator	HTML, Javascript, CSS	Yahoo! Widget engine

TV Guidelines

- Web Accessibility
  - WCAG 2.0

- TV accessibility
  - *Digital Terrestrial Television Accessibility Recommendations* by INTECO
  - ITU's *Recommendation F.790*
  - *Guidelines for Digital TV equipment and services*
  - *UK Digital TV Usability and Accessibility guidelines*

Assistive Technologies

- **Audio description** makes the TV services more accessible to blind and visually impaired people by explaining what is happening on screen using the gaps in dialogue.
  - BBC describes 20% of its channels' content
  - RTP provides AD through radio or DTV box
- There are some "talking" TVs (e.g. Elderis)
- Research projects (e.g. GUIDE)

Survey

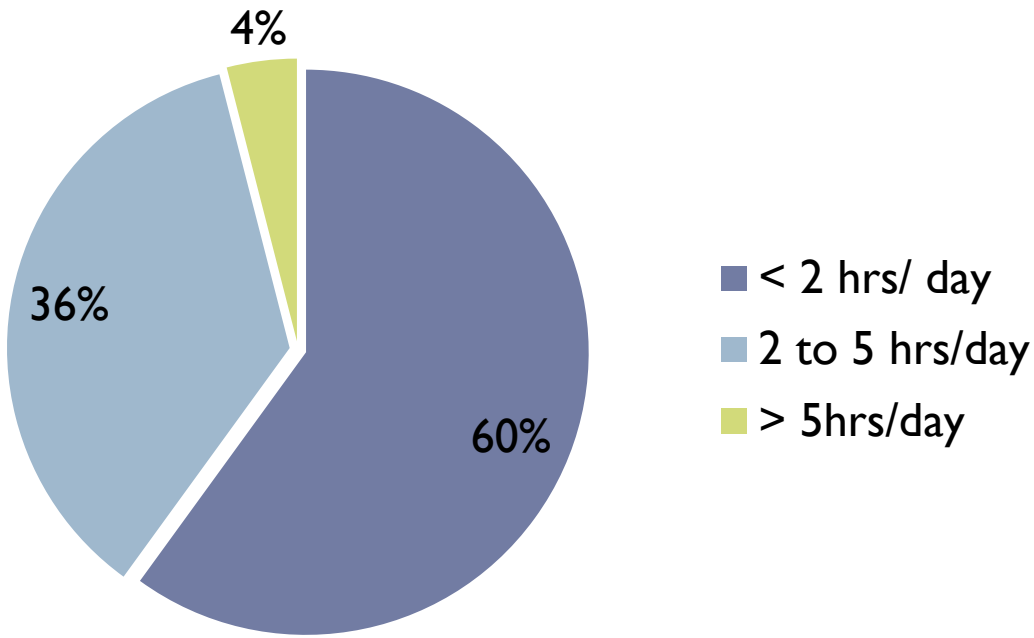
Survey - Understand the problems

- The questionnaire was composed by three parts: personal information; **consumption habits on TV**, computer, mobile phone and tablet; and **interaction and technology acceptance** related affirmations.

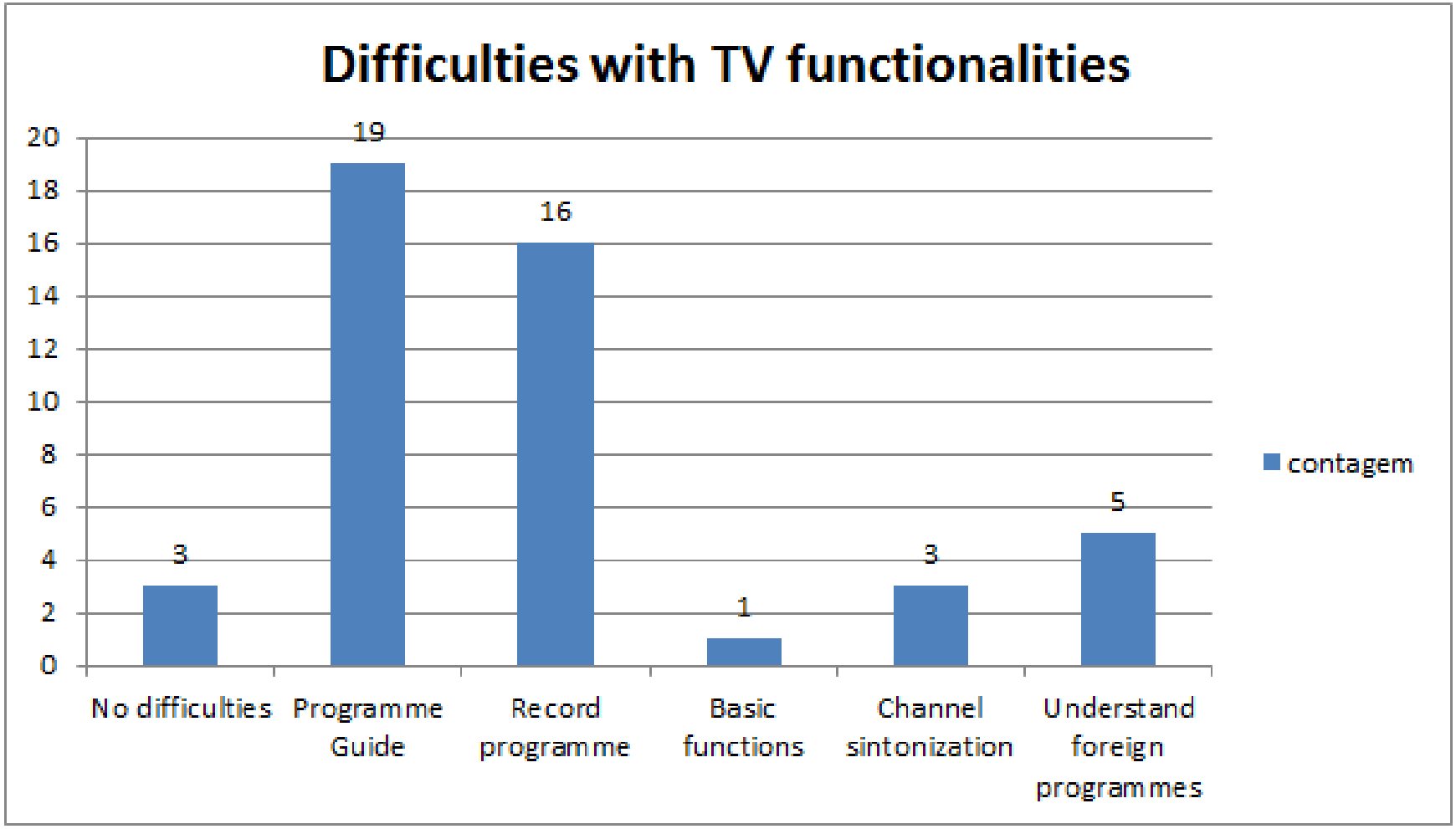
- 26 persons with visual impairments (17 males and 9 females), ranging from 22 to 64 years of age (M = 41, SD = 13).

Survey – Results

- 96% of the participants have a TV set at home
- 20 of them are provided by paid services rather than Digital Terrestrial Television (DTT), where 19 include internet



Survey – Results



Survey - Results

Affirmation	Average	SD	Max	Min	Mode
I would feel comfortable talking to my TV	5,9	1,9	7	1	7
I would like to control my TV using a Smartphone or Tablet	6	1,6	7	1	7
If more accessible I would get the information I want through the TV instead of the PC	5,7	2,1	7	1	7
I welcome new ways of interacting with the TV	6,8	0,6	7	4	7
If TV applications were simpler than Web applications I would use them even though this signify less features or content	5,7	2	7	1	7
I can navigate well through the menus and options offered by my TV set	2	1, 9	7	1	1
I do not need any help when interacting with my TV	2,9	2,5	7	1	1
I am interested in all types of media (text, images and video)	6,4	1,5	7	2	7
I am interested in accessing Web applications through the TV	6,3	1,5	7	1	7
The lack of accessibility features on my TV has prevented me to enjoy a show before	6,5	1,3	7	1	7

Survey - Discussion

- This study shows that currently visually impaired users **do not use their TV much**.

- Also **participants often struggle to perform more complex tasks** such as consulting the programme guide or to record a show.

- There are indications that **if made more accessible** this platform could replace the use of computers regarding the search for information.

Automated and Manual Evaluation of TV based applications

Accessibility Evaluation

- Hypothesis was defined: *TV applications are less conformant with accessibility guidelines than their Desktop counterparts.*

- Automated and Manual evaluation
  - Using QualWeb tool (Fernades et al.)
  - Barrier walkthrough

Accessibility Evaluation

- Opera TV platform
- We evaluated 20 Applications from the Opera TV Store with TV and Desktop versions

Accessibility Evaluation - Results

Application	Conservative TV	Conservative Web	Optimistic TV	Optimistic Web	Strict TV	Strict Web
Roda Viva	0.9294605809	0.2698087432	0.9543568465	0.7322404372	0.9531914894	0.501905972
WOWTV	0.7022375215	0.4777936963	0.9707401033	0.7113180516	0.96	0.623364486
Vimeo	0.9626666667	0.4680365297	0.9786666667	0.7842465753	0.9783197832	0.6844741235
WatchMojo	0.6149068323	0.2453970081	0.801242236	0.7353279632	0.7557251908	0.481105471
Melynga	0.5949820789	0.5765765766	0.8745519713	0.8238238238	0.8258706468	0.7659574468
FreshMilk	0.3470319635	0.6896992962	0.6894977169	0.8950735765	0.5277777778	0.8679549114
Redbull TV	0.5422535211	0.3746928747	0.823943662	0.7604422604	0.7549019608	0.61
RantSports	0.6724637681	0.2752695418	0.8985507246	0.7887466307	0.8689138577	0.5657894737
iG Moda	0.74393531	0.4291767554	0.8032345013	0.7947941889	0.7908309456	0.6765267176
AllTime10s	0.6270627063	0.7432762836	0.8844884488	0.8899755501	0.8444444444	0.8710601719
TechCrunch	0.7767295597	0.4578544061	0.8710691824	0.7720306513	0.8576388889	0.6675977654
GameReactor	0.7171572146	0.3124528302	0.8578607322	0.7132075472	0.8345864662	0.5214105793
AccuWeather	0.6631944444	0.5109830753	0.7916666667	0.8138278718	0.7609561753	0.7329545455
Facebook	0.7381818182	0.6355893186	0.8663636364	0.7937384899	0.8467153285	0.7549904293
Manga	0.6149068323	0.4705488621	0.801242236	0.7858099063	0.7557251908	0.6871945259
Bola.net	0.7884097035	0.374941452	0.897574124	0.7494145199	0.8850226929	0.5994009734
Cocoricó	0.9294605809	0.2389502762	0.9543568465	0.7458563536	0.9531914894	0.4845938375
CNBC	0.8535031847	0.4889715652	0.8853503185	0.8283284613	0.8815789474	0.7401448109
AsianCrush	0.7210526316	0.2303875969	0.8578947368	0.7680620155	0.8353658537	0.498323273
CNNExpansion	0.8741721854	0.4700233584	0.9072847682	0.7778354529	0.904109589	0.67904012
Average	**0.7206884552**	**0.4370215023**	**0.8684968063**	**0.7832050164**	**0.8387433359**	**0.6506894817**

Accessibility Evaluation - Discussion

- The outcome revealed that **TV applications are more conformant** with the **WCAG** accessibility guidelines
  - Our hypothesis was rejected

- One reason relates to page complexity / number of elements (Lopes et al.)
  - TV versions (M = 255, SD = 194) have less than a fifth elements when compared with the desktop versions (M = 1554, SD = 923)

- If they are so accessible why aren't they recommended to the impaired users as an alternative?

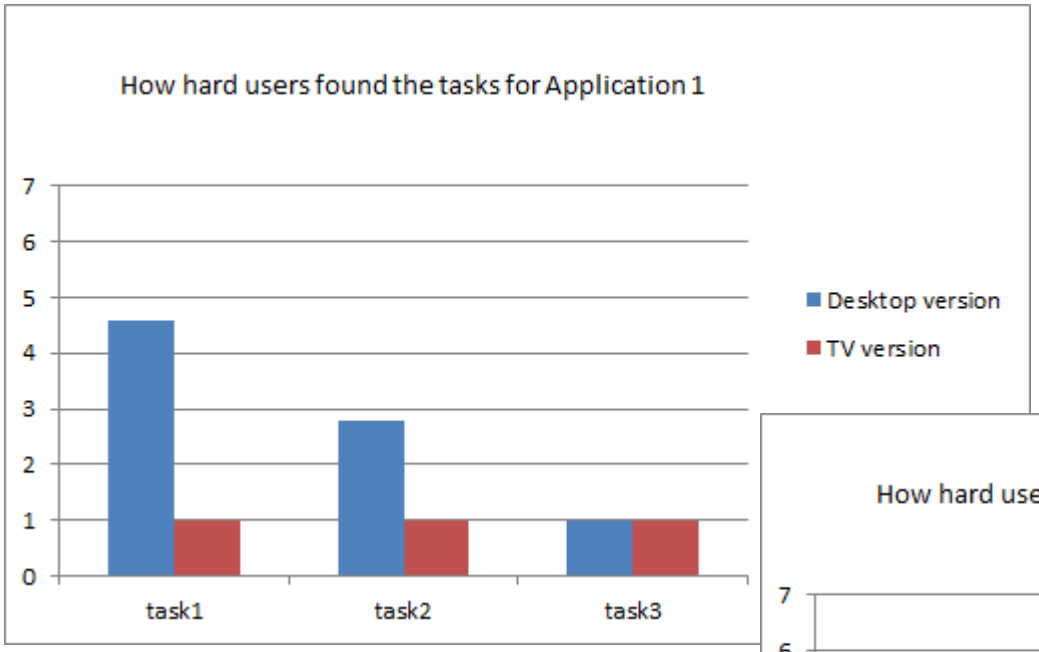
Accessibility Evaluation – User Study

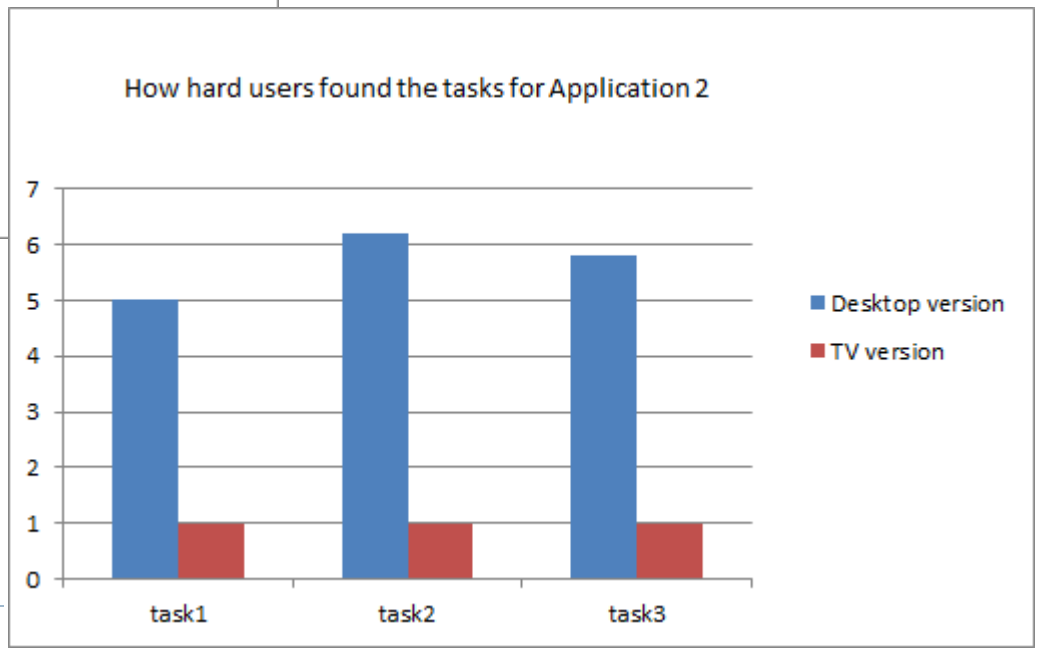
- To complement the automated evaluation study, we devised a small experiment with 5 randomly chosen participants of the questionnaire.

- Participants were asked to perform the same **3 tasks** on both **TV and Desktop** version of the same application. This was done on two different applications.

- Participants used **JAWS** as their assistive technology – a popular screen reader

Accessibility Evaluation – Results

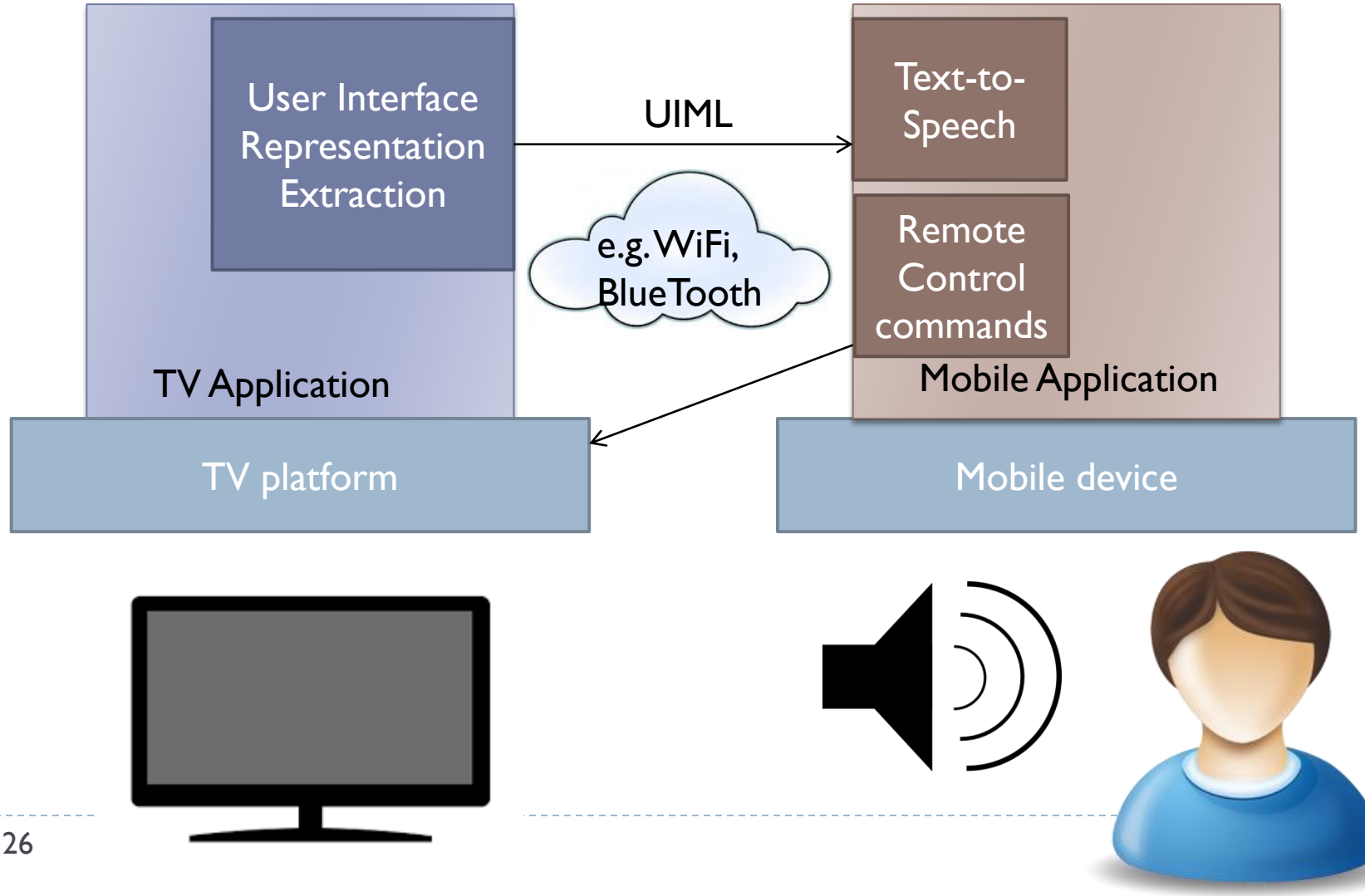




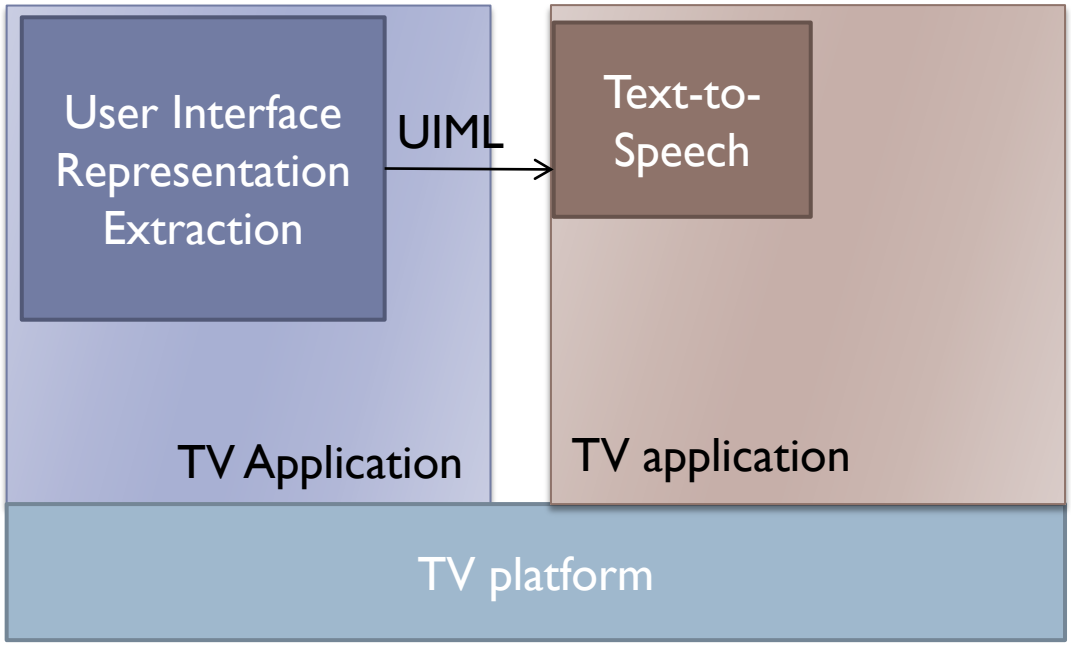
Accessibility Evaluation – Discussion

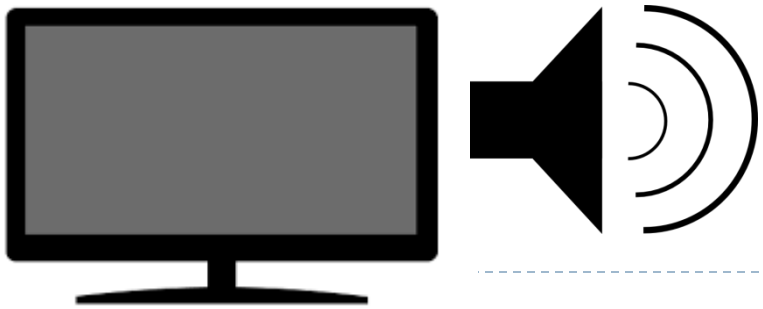
- Users **did not complete any task** on the **TV versions**
  - Their strategies usually applied when interacting with the Web did not work
  - TV applications are not based on links for navigation
- Using the available tools we can conclude that currently **TV applications are not accessible** despite the positive results on the automated evaluation.
- We identified a problem and confirmed its impact, the next step is to find a proper solution

Brainstorming – A possible solution



Brainstorming – A possible solution 2





Thanks

- Mail: dancosta@di.fc.ul.pt