How to create accessible SW

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What it means accessible?

- Visual impairment
  - control: keyboard navigation
  - presentation: audio/haptic; large graphics
  - data input: keyboard, gestures
- Motor impairment
  - control: large controls for direct manipulation (mouse, touch), keyboard navigation
  - presentation: <no limitations>
  - data input: keyboard, virtual keyboard, voice, direct manipulation
- Hearing impairment
  - control: keyboard/mouse navigation
  - presentation: visual/haptic
  - data input: keyboard, direct manipulation (mouse, touch)

What it means accessible?

- **What about combinations?**
  - Deaf-blind impairment
  - Motor-blind impairment
  - Motor-deaf impairment

Accessible RIA

RIA

- **What is Rich Internet Application (RIA)?**
  - **New approach on Internet**
  - **Websites look more like desktop applications**
    - **Online documents**
    - **E-mail**
    - **Instant messaging**
    - **Calendar**
    - **Social networking**
- **Number of RIA rapidly increasing**
- **Possible benefits for handicapped people working with Internet**

RIA +/-

- RIA pros
  - Higher comfort
    - Suggestions
    - Immediate feedback
  - Better user experience
    - Drag&Drop
    - Sophisticated components (tree, collapsible panel)
  - Dynamics
    - Chat
    - Shared data
    - Collaboration

- RIA cons
  - Not transparent
    - Many concurrent changes
    - Complex components
  - Unclear structure
    - Content (not in HTML)
    - Semantics in code of scripts
  - Problematic keyboard navigation
  - Difficult controlling of components
  - Dependency on JavaScript

WAI-ARIA

- RIA is less accessible than "standard" web pages
  - How this can be solved?
- Web Accessibility Initiative (WAI)
  - part of W3C consortium
- Accessible Rich Internet Application suite of W3C (WAI-ARIA)
  - Working draft
  - Recommendations on how to make RIA accessible
    - Additional metadata
    - Bring back the semantics into HTML code
  - No restrictions on current functionality

a11y issues tackled by ARIA

- Keyboard-only operation impossible
- Orientation in content
  - Missing appropriate labels
  - Hiding of some content without announcement
    - Tab panels
    - Collapsible panels
- Controlling of UI components
  - Wrong or missing tab order
  - Focus stacking or disappearing
  - Wrong or missing status announcement
    - Checkbox
    - Radio Button
    - Slider

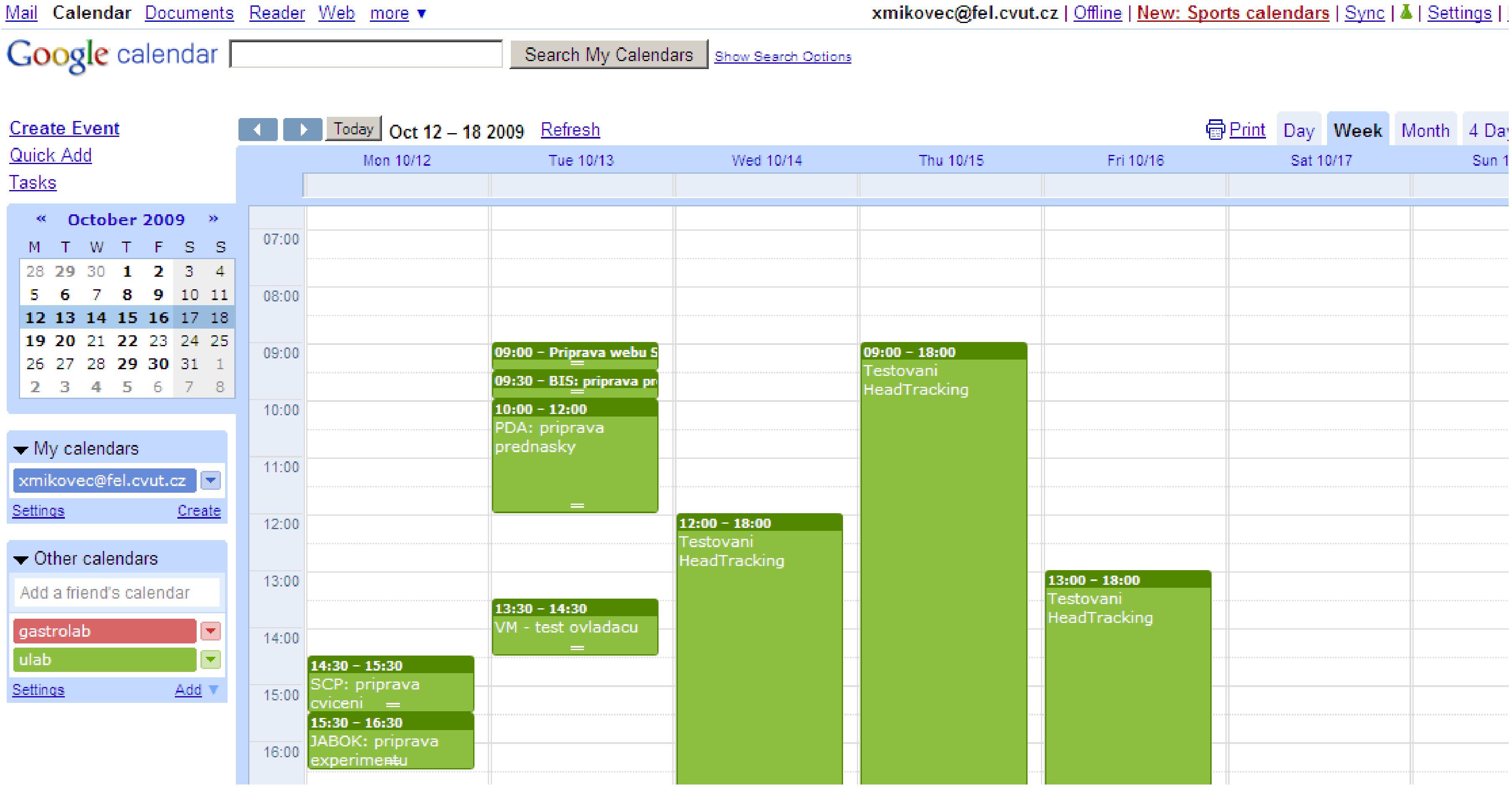
aria-labeledby

aria-expanded

tabindex

checked

RIA and a11y



« October 2009 »

M	T	W	T	F	S	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

	Mon 10/12	Tue 10/13	Wed 10/14	Thu 10/15	Fri 10/16	Sat 10/17	Sun 1
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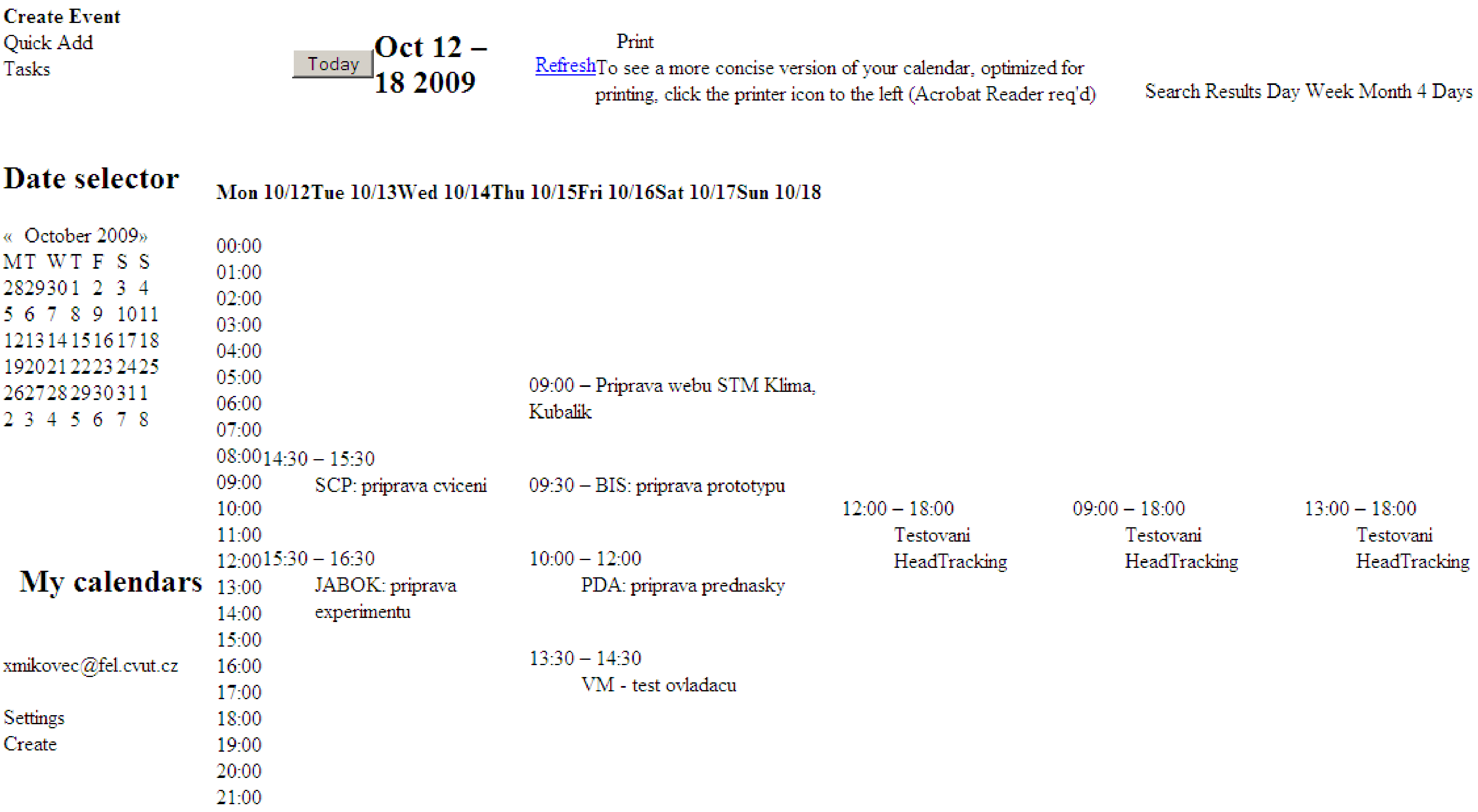
08:00							
09:00		09:00 – Priprava webu S 09:30 – BIS: priprava pr		09:00 – 18:00 Testovani HeadTracking			
10:00		10:00 – 12:00 PDA: priprava prednasky					
11:00							
12:00			12:00 – 18:00 Testovani HeadTracking				
13:00		13:30 – 14:30 VM - test ovladacu			13:00 – 18:00 Testovani HeadTracking		
14:00	14:30 – 15:30 SCP: priprava cviceni						
15:00	15:30 – 16:30 JABOK: priprava experimentu						
16:00							

RIA and a11y



Create Event
Quick Add
Tasks

Today **Oct 12 – 18 2009**

Print
Refresh To see a more concise version of your calendar, optimized for printing, click the printer icon to the left (Acrobat Reader req'd)

Search Results Day Week Month 4 Days

Date selector

« October 2009»

M	T	W	T	F	S	S
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
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Mon 10/12Tue 10/13Wed 10/14Thu 10/15Fri 10/16Sat 10/17Sun 10/18

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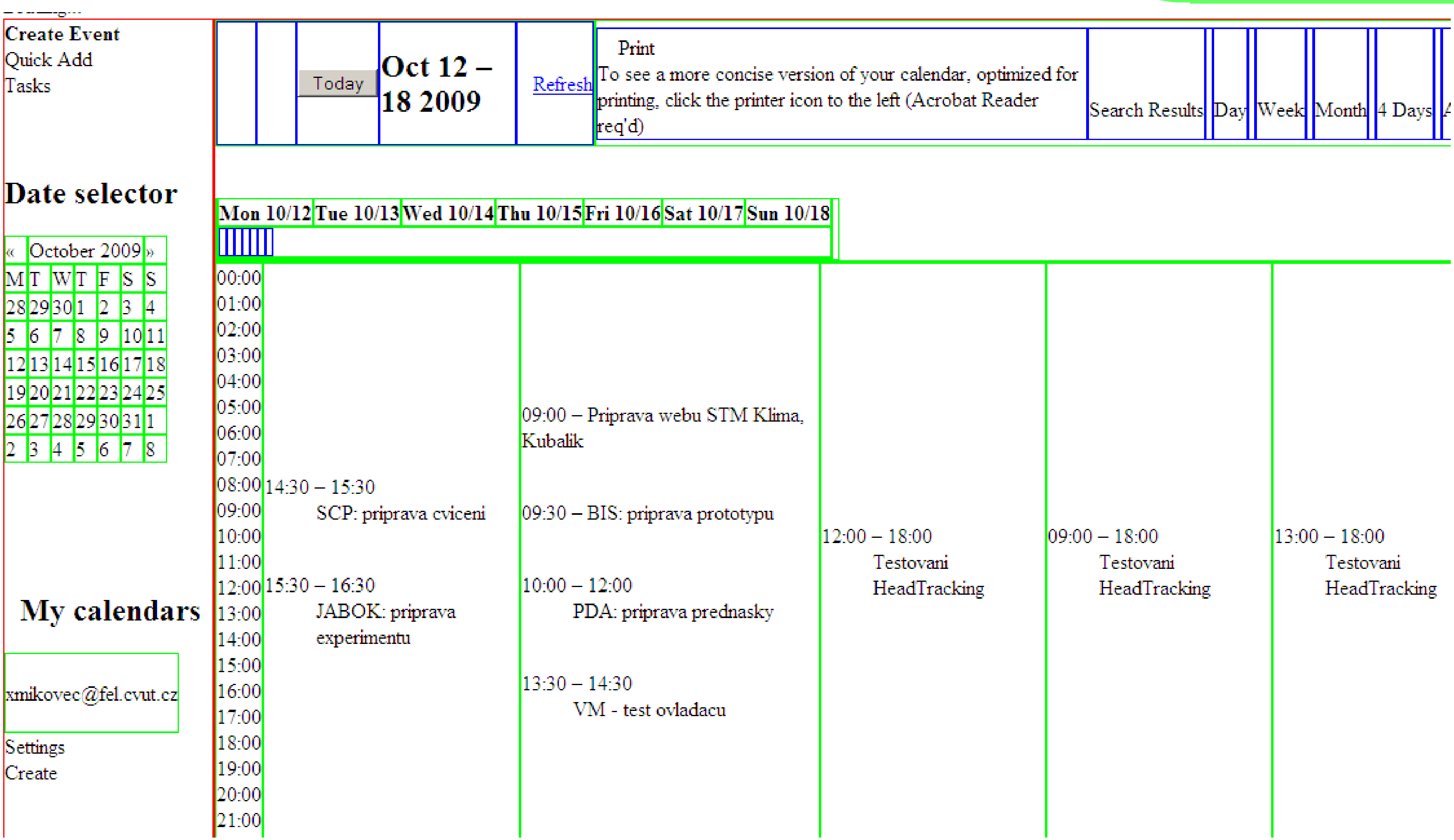
05:00 09:00 – Priprava webu STM Klima, Kubalik
06:00
07:00
08:00 14:30 – 15:30
09:00 SCP: priprava cviceni 09:30 – BIS: priprava prototypu
10:00 12:00 – 18:00 Testovani HeadTracking 09:00 – 18:00 Testovani HeadTracking 13:00 – 18:00 Testovani HeadTracking
11:00
12:00 15:30 – 16:30 10:00 – 12:00
13:00 JABOK: priprava experimentu PDA: priprava prednasky
14:00
15:00
16:00 13:30 – 14:30 VM - test ovladacu
17:00
18:00
19:00
20:00
21:00

My calendars

xmikovec@fel.cvut.cz

Settings
Create

RIA and a11y



Create Event
Quick Add
Tasks

Today

Oct 12 – 18 2009

Refresh

Print
To see a more concise version of your calendar, optimized for printing, click the printer icon to the left (Acrobat Reader req'd)

Search Results | Day | Week | Month | 4 Days | A

Date selector

«	October 2009					»
M	T	W	T	F	S	S
28	29	30	1	2	3	4
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Mon 10/12 | **Tue 10/13** | **Wed 10/14** | **Thu 10/15** | **Fri 10/16** | **Sat 10/17** | **Sun 10/18**

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Testovani HeadTracking

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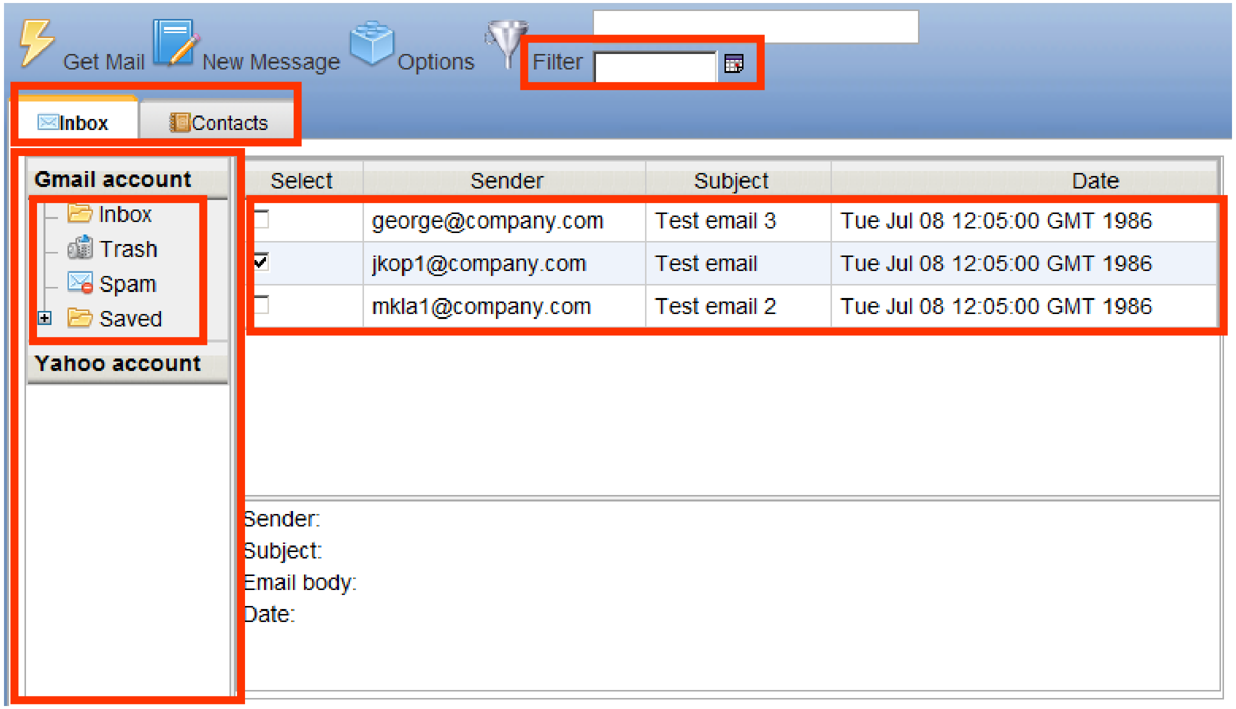
Settings
Create

Creation of ARIA

Rich environment of RIA

- Modern RIA applications are build from components
  - Tree
  - Tabs
  - Accordion
  - Grid
  - etc.



Select	Sender	Subject	Date
□	george@company.com	Test email 3	Tue Jul 08 12:05:00 GMT 1986
☑	jkop1@company.com	Test email	Tue Jul 08 12:05:00 GMT 1986
□	mkla1@company.com	Test email 2	Tue Jul 08 12:05:00 GMT 1986

Sender:
Subject:
Email body:
Date:

Rich world of RIA

- Web environment is extremely variable
- Accessibility depends on:
  - Type of OS
    - Windows, Linux, Mac, …
  - Type of Web browser
    - Firefox, IE, Safari, Chrome, …
  - Type of Screen reader
    - Jaws, NVDA, Orca, …

- No configuration is 100% ARIA compliant

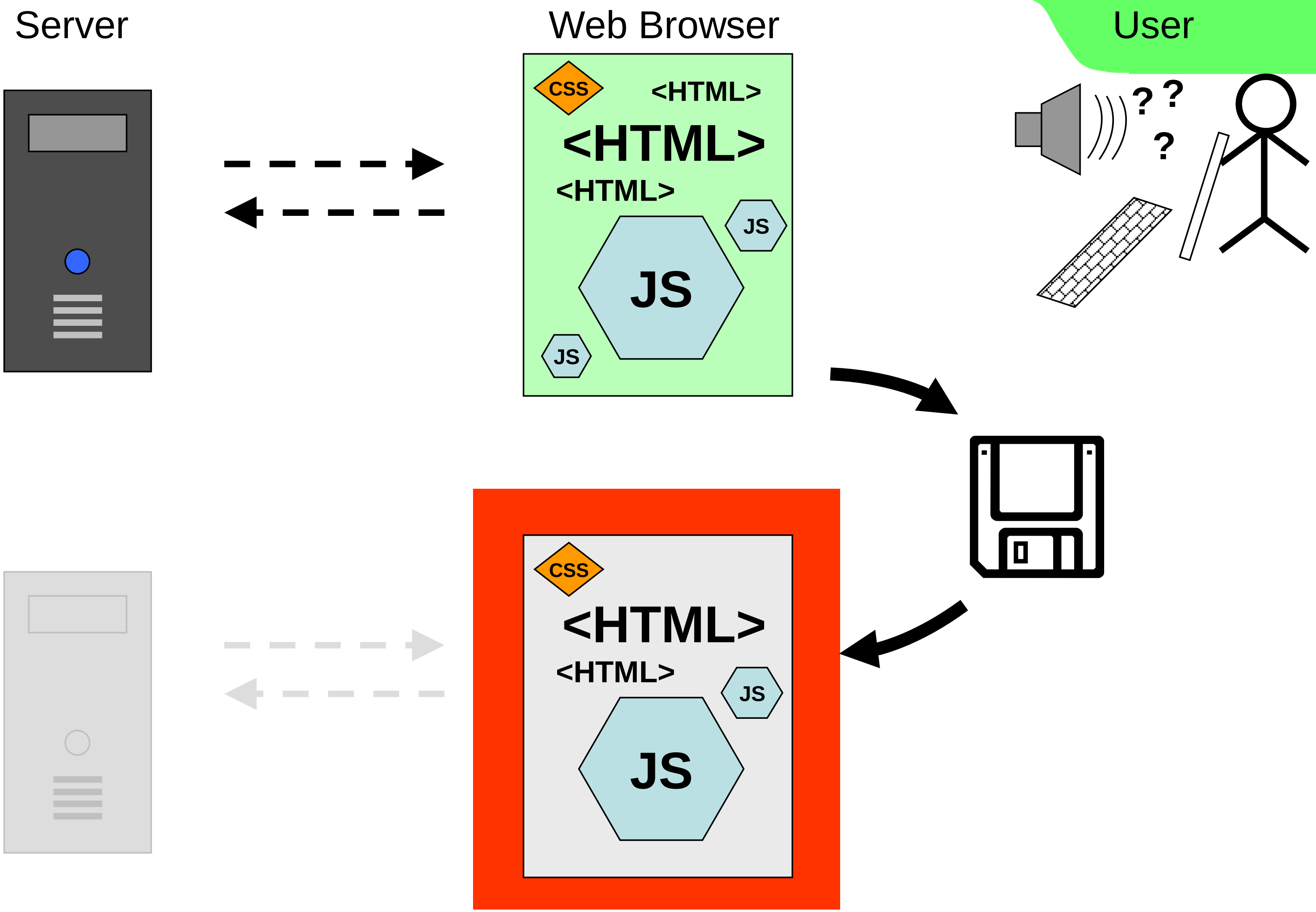
Three steps towards accessible RIA

1. Accessibility of RIA components
2. Accessibility of RIA applications
3. Testing of application accessibility

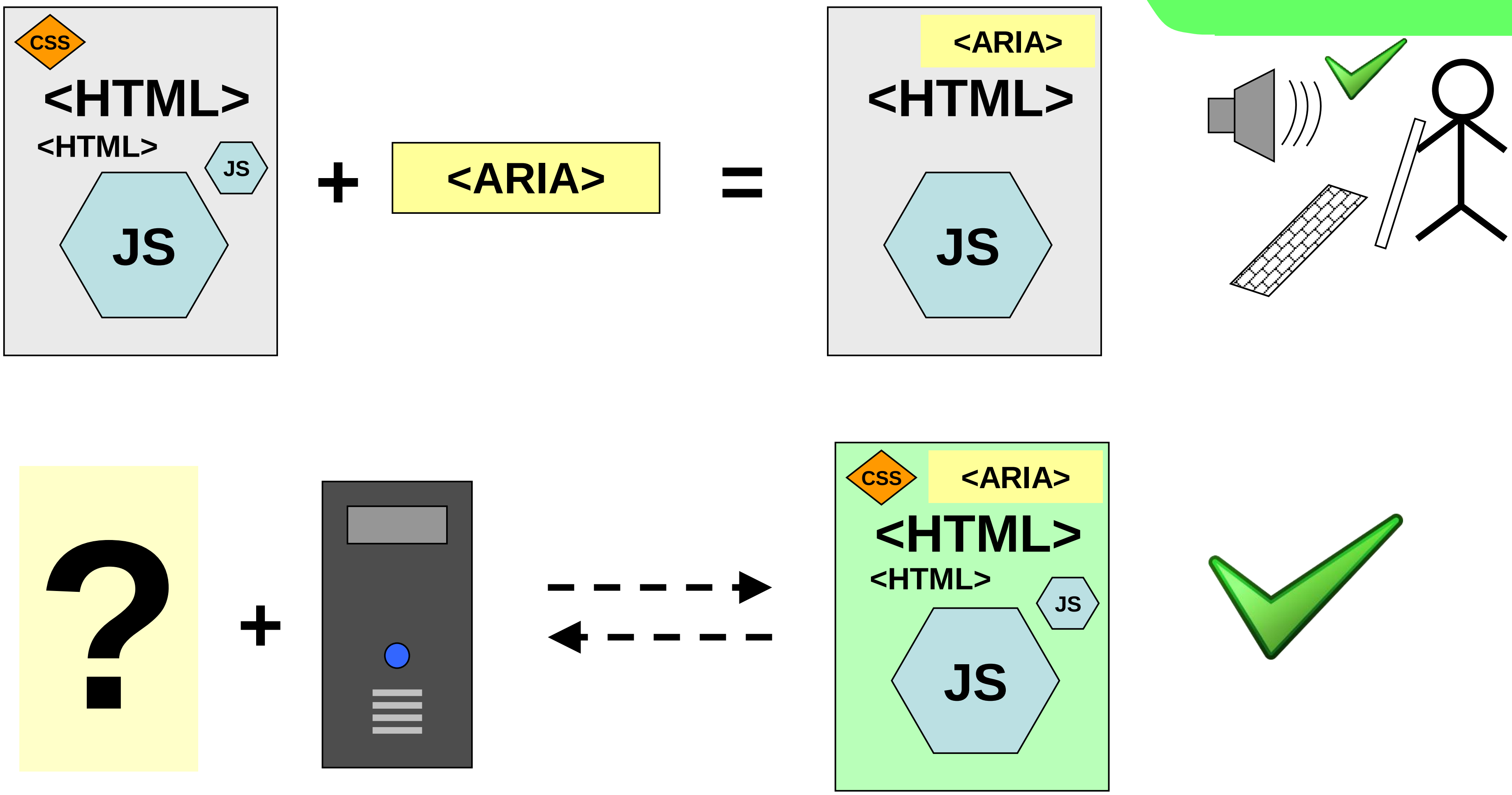
Three steps towards accessible RIA

1. **Accessibility of RIA components**
2. Accessibility of RIA applications
3. Testing of application accessibility

Offline component prototype



Offline component prototype



Accessibility of RIA components

1. Create offline component prototype
2. Simplify the component architecture
3. Add WAI-ARIA attributes into offline component prototypes
   - Implementing ARIA attributes
   - Implementing keyboard navigation
4. Implement changes back to the server
   - Test whether results are accessible

Three steps towards accessible RIA

1. Accessibility of RIA components
2. **Accessibility of RIA applications**
3. Testing of application accessibility

Issues to be implemented

- Navigation on the page
- Relationships between components
- Dynamic changes of presented information

- Created set of 11 heuristics based on Nealson’s usability heuristics

Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. Use headings to mark important areas
4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. Create proper linkage of controls, labels and messages
7. Distinguish all components
8. Define complete keyboard operation and where possible, standardize
9. Define document structure with ARIA landmarks
10. Provide a logical tab order
11. Use buttons for functions and links for linking

Heuristics

1. **Design with screen reader modes in mind**

Screen readers and another assistive technologies use **several browsing modes**. Make sure all parts of the web page are accessible at least with **“virtual cursor”** and **“forms mode”**. In forms mode all information in the form area must be linked to one of the form elements as a label or description.

2.
3.
4.
5. soon as
6. s
7.
8. Define complete keyboard operation and where possible, standardize
9. Define document structure with ARIA landmarks
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Heuristics

1. Design with screen reader modes in mind
2. **Provide text alternative for all non-textual elements**

Icons and other similar visual elements that carry information to the user should have a textual alternative available. The only **exception** is when a non-textual element is used for **decoration** or layout purposes.

3.
4.
5. soon as
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7.
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Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. **Use headings to mark important areas**

Headings are the only elements with various levels of importance. They are often **used to scan the content** and should be used when possible to denote sections.

4.
5. soon as

6. s
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Heuristics

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> When showing larger section **move focus** to the section. When showing a **tooltip** all content should be **connected as description**.

Heuristics

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Use **on-the-fly validation** where possible. Use **live regions** to communicate asynchronous messages.

Heuristics

1. Design with screen reader modes in mind
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4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. **Create proper linkage of controls, labels and messages**
7.
8. le,

Connect menus with corresponding **dynamically loaded sections** using aria-controls.

9. Define document structure with ARIA landmarks
10. Provide a logical tab order
11. Use buttons for functions and links for linking

Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. Use headings to mark important areas
4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. Create proper linkage of controls, labels and messages
7. **Distinguish all components**
8. le,
9.

All components that have their **Roles** identified in WAI-ARIA should be marked using appropriate Role.

10. Provide a logical tab order
11. Use buttons for functions and links for linking

Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. Use headings to mark important areas
4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. Create proper linkage of controls, labels and messages
7. Distinguish all components
8. **Define complete keyboard operation and where possible, standardize**

9.

10.

11.

> **Use design patterns** defined in WAI-ARIA or DHTML Style Guide to determine the proper **keyboard navigation** before implementing your own.

Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. Use headings to mark important areas
4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. Create proper linkage of controls, labels and messages
7.
8. le,

Identify as **many** common structure parts as possible and apply WAI-ARIA **landmark roles** to them.

9. **Define document structure with ARIA landmarks**
10. Provide a logical tab order
11. Use buttons for functions and links for linking

Heuristics

1. Design with screen reader modes in mind
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7.
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9.
10. **Provide a logical tab order**
11. Use buttons for functions and links for linking

Menus should be **close** in the means of tab order **to the sections** they are affecting. Tab order is important as it is **used to quickly scan** the page for interactive components. If the tab order is faulty, the mental model of the web page will likely be incorrect.

Heuristics

1. Design with screen reader modes in mind
2. Provide text alternative for all non-textual elements
3. Use headings to mark important areas
4. Handle hidden section appropriately
5. Communicate important information and feedback as soon as possible
6. Create proper linkage of controls, labels and messages
7.
8. le,
9.
10.
11. **Use buttons for functions and links for linking**

Make clear **distinction between buttons and links**. For all functions that are available on the page use buttons. For navigation purposes and for linking to other pages or anchoring, use links.

Three steps towards accessible RIA

1. Accessibility of RIA components
2. Accessibility of RIA applications
3. **Testing of application accessibility**

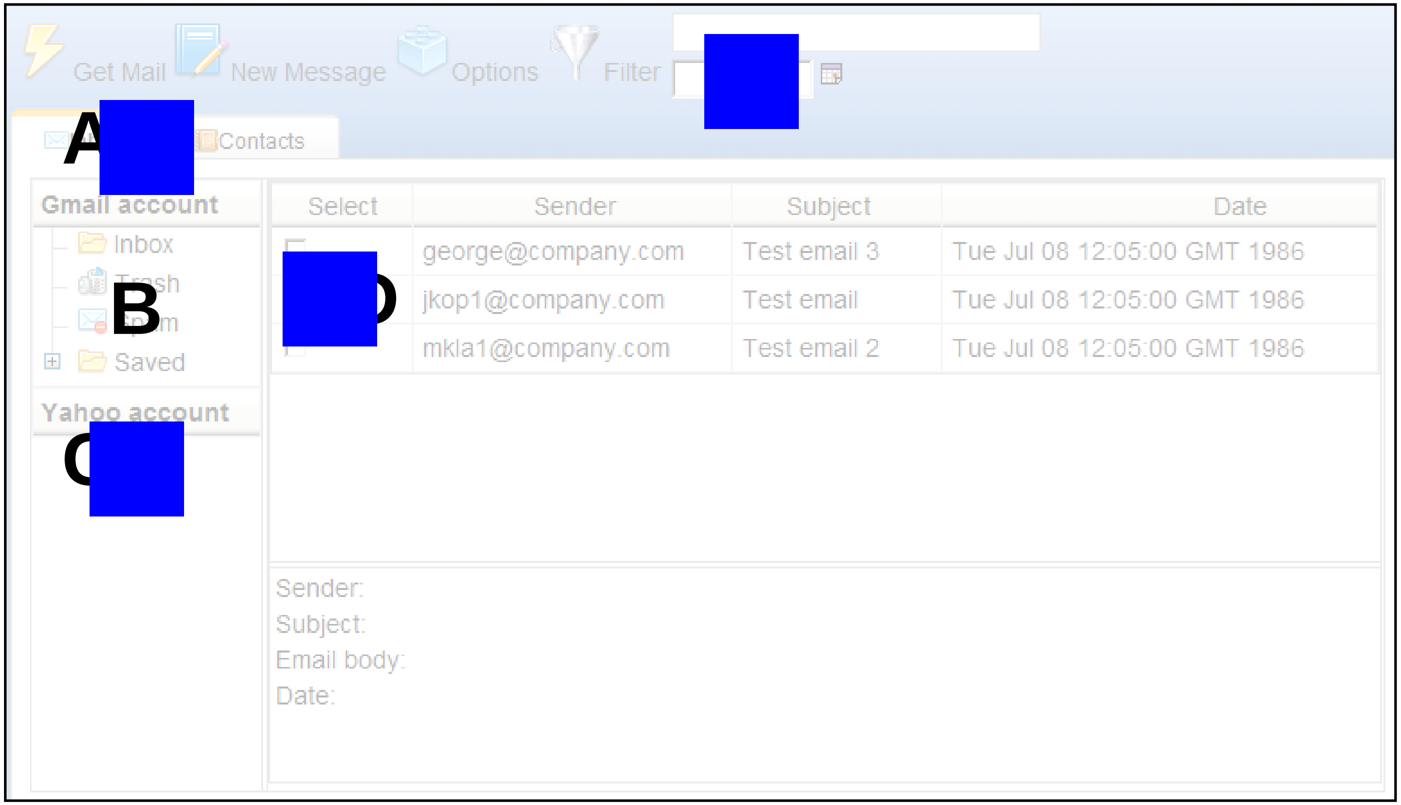
Testing of application accessibility

- Developer is typically NOT:
  - Blind user
  - Used to operate screen reader
- Need for accessibility testing with blind users

- Early stages of development means:
  - Poor accessibility
  - Need for support of accessibility testing

View of blind user

- **User sees some components just partially or they seem missing**

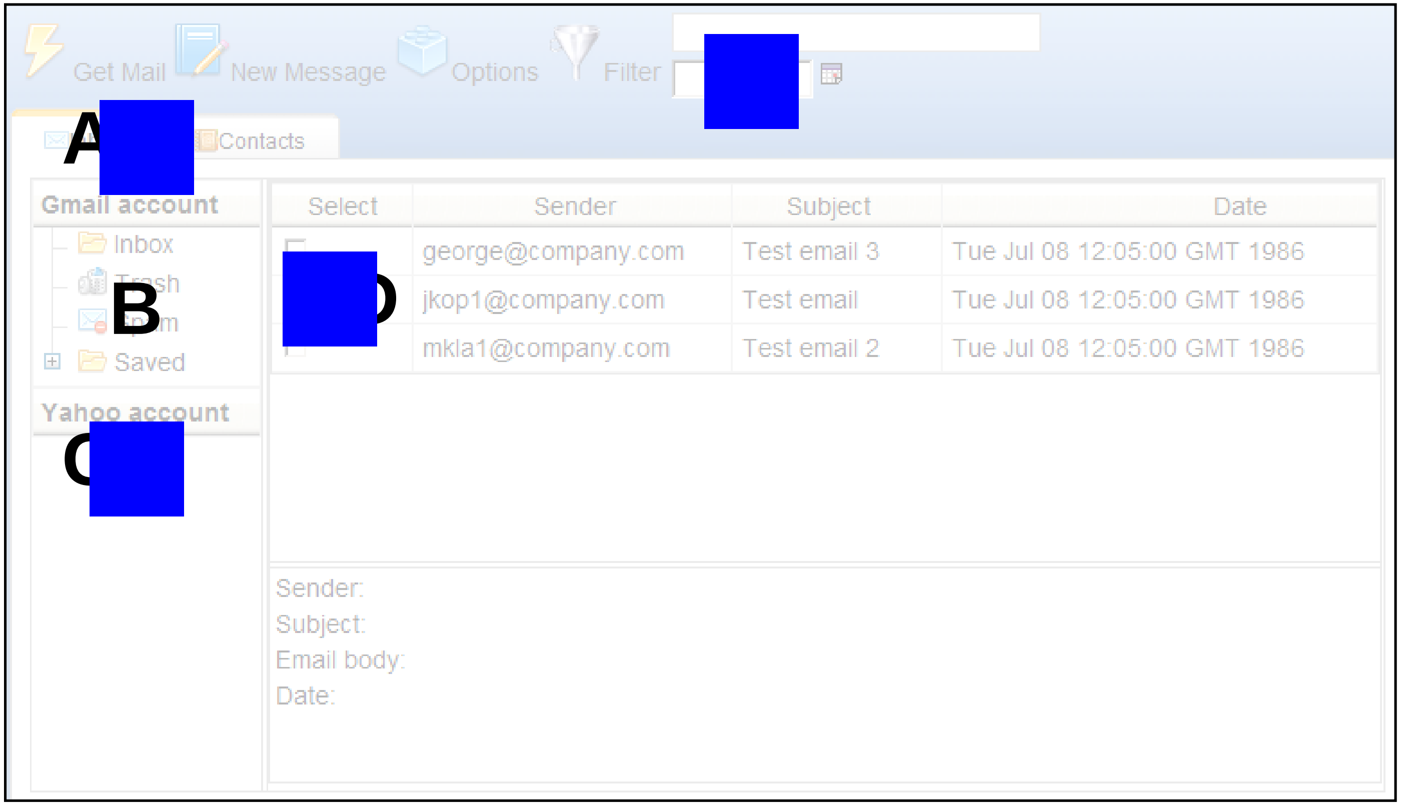


Select	Sender	Subject	Date
□	george@company.com	Test email 3	Tue Jul 08 12:05:00 GMT 1986
□	jkop1@company.com	Test email	Tue Jul 08 12:05:00 GMT 1986
□	mkla1@company.com	Test email 2	Tue Jul 08 12:05:00 GMT 1986

Sender:
Subject:
Email body:
Date:

View of developer

- **Developer sees all the components**



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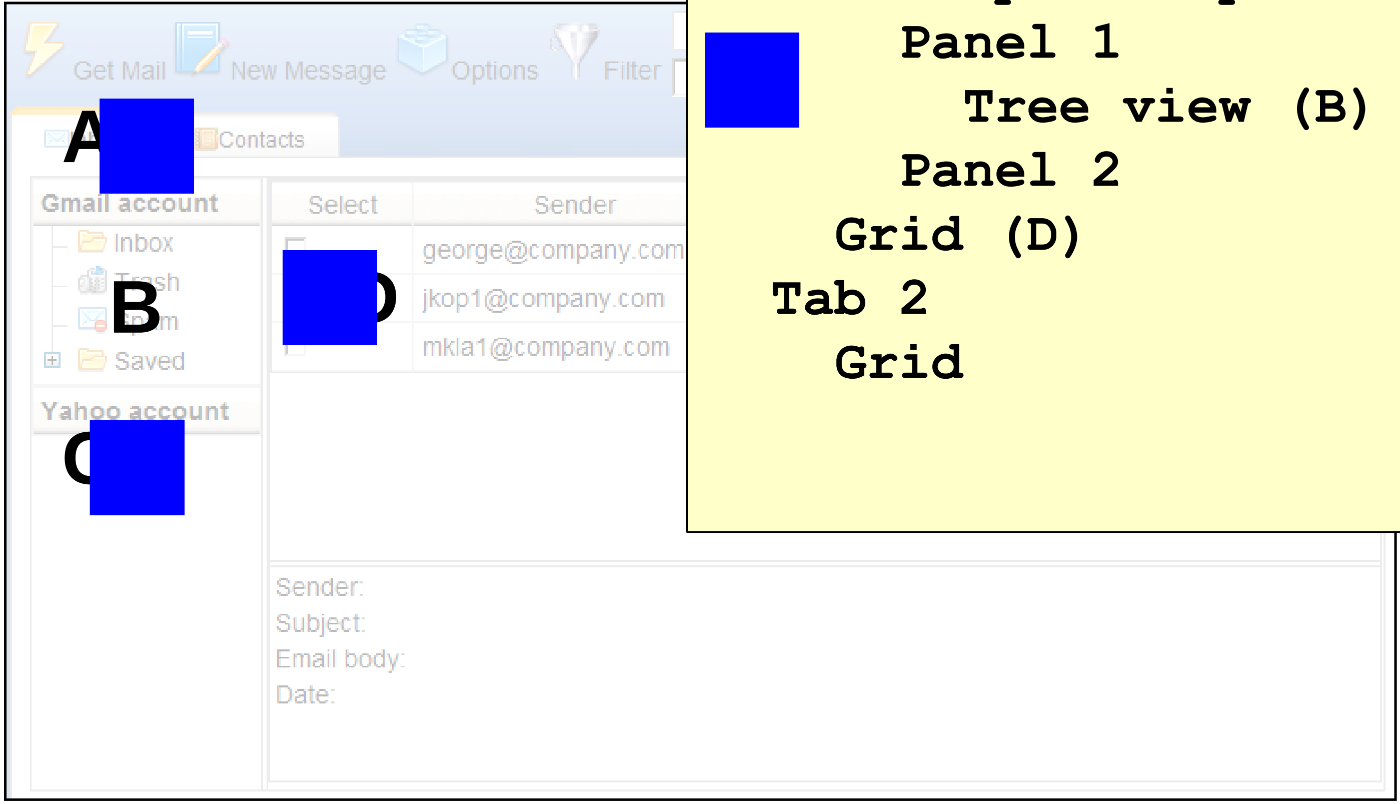
□	mkla1@company.com	Test email 2	Tue Jul 08 12:05:00 GMT 1986

Sender:
Subject:
Email body:
Date:

View of user with description

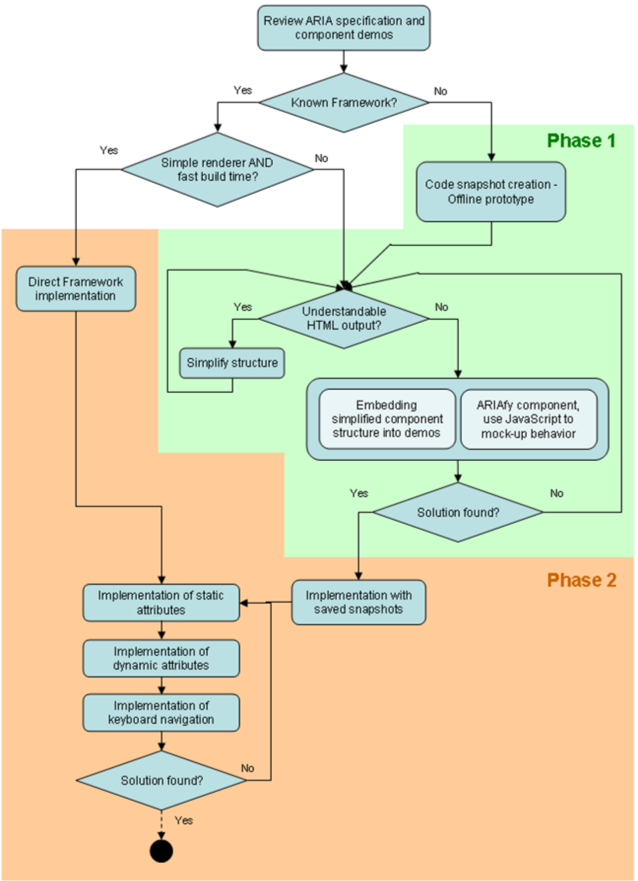


Sender:
Subject:
Email body:
Date:

- Datepicker (E)
- Tablist (A)
  - Tab 1
    - Collapsible panel (C)
      - Panel 1
        - Tree view (B)
      - Panel 2
    - Grid (D)
  - Tab 2
    - Grid

RIA accessibility - summary

- RIA accessibility is complicated and complex process
  - Has to be treated in phases
- Valid testing is complicated
  - Support of blind tester needed


Review ARIA specification and component demos
Known Framework?
Yes
No
Simple renderer AND fast build time?
Yes
No
Phase 1
Code snapshot creation - Offline prototype
Direct Framework implementation
Understandable HTML output?
Yes
No
Simplify structure
Embedding simplified component structure into demos
ARIAfy component, use JavaScript to mock-up behavior
Solution found?
Yes
No
Phase 2
Implementation of static attributes
Implementation with saved snapshots
Implementation of dynamic attributes
Implementation of keyboard navigation
Solution found?
No
Yes

Simulation and inspection tools

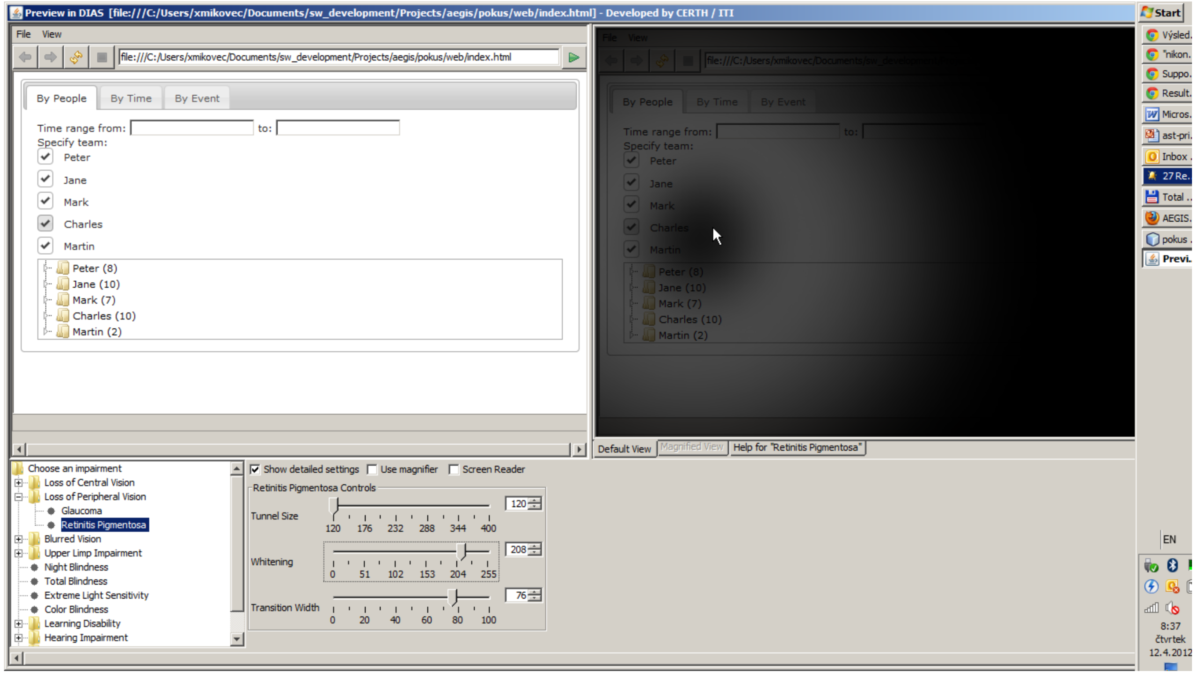
Color checkers

- Simulates color blindness and other visual impairments

- Web applications
  - http://webaim.org/resources/contrastchecker/
  - http://www.snook.ca/technical/colour_contrast/colour.html
- Firefox extensions
  - Web Developer
  - Color Checker

DIAS: Disability Impairment Approximation Tool

- Simulation of impairments
- Inspection of the code
- Integration with IDE (NetBeans)
- http://sourceforge.net/projects/diasnb/



Preview in DIAS [file:///C:/Users/xmikovec/Documents/sw_development/Projects/aegis/pokus/web/index.html] - Developed by CERTH / ITI

file:///C:/Users/xmikovec/Documents/sw_development/Projects/aegis/pokus/web/index.html

By People | By Time | By Event

Time range from: to:

Specify team:

☑ Peter

☑ Jane

☑ Mark

☑ Charles

☑ Martin

- Peter (8)
- Jane (10)
- Mark (7)
- Charles (10)
- Martin (2)

Default View | Magnified View | Help for "Retinitis Pigmentosa"

- Choose an impairment
  - Loss of Central Vision
  - Loss of Peripheral Vision
    - Glaucoma
    - Retinitis Pigmentosa
  - Blurred Vision
  - Upper Limp Impairment
  - Night Blindness
  - Total Blindness
  - Extreme Light Sensitivity
  - Color Blindness
  - Learning Disability
  - Hearing Impairment

☑ Show detailed settings ☐ Use magnifier ☐ Screen Reader

Retinitis Pigmentosa Controls

Tunnel Size: 120

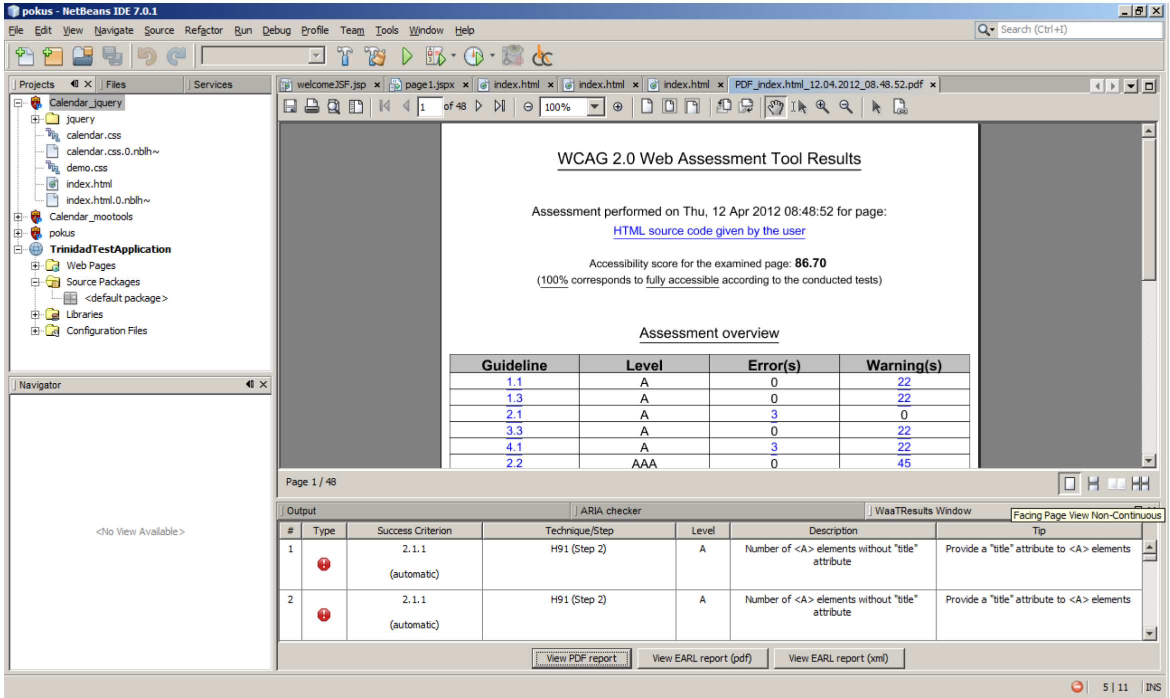
Whitening: 208

Transition Width: 76

WaaT: Web A11y assessment tool

- Assesses the a11y of web applications
- Integrated with IDE (NetBeans)

- http://sourceforge.net/projects/waat/



WCAG 2.0 Web Assessment Tool Results

Assessment performed on Thu, 12 Apr 2012 08:48:52 for page:
HTML source code given by the user

Accessibility score for the examined page: **86.70**
(100% corresponds to fully accessible according to the conducted tests)

Assessment overview

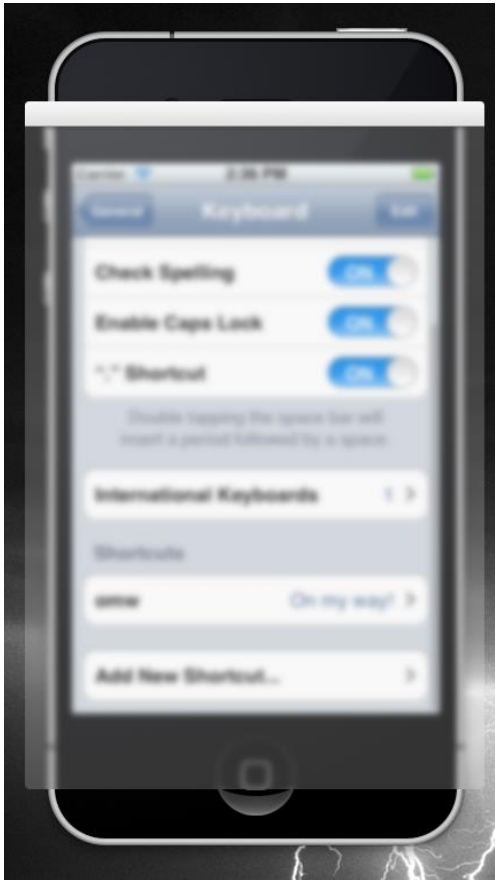
Guideline	Level	Error(s)	Warning(s)
1.1	A	0	22
1.3	A	0	22
2.1	A	3	0
3.3	A	0	22
4.1	A	3	22
2.2	AAA	0	45

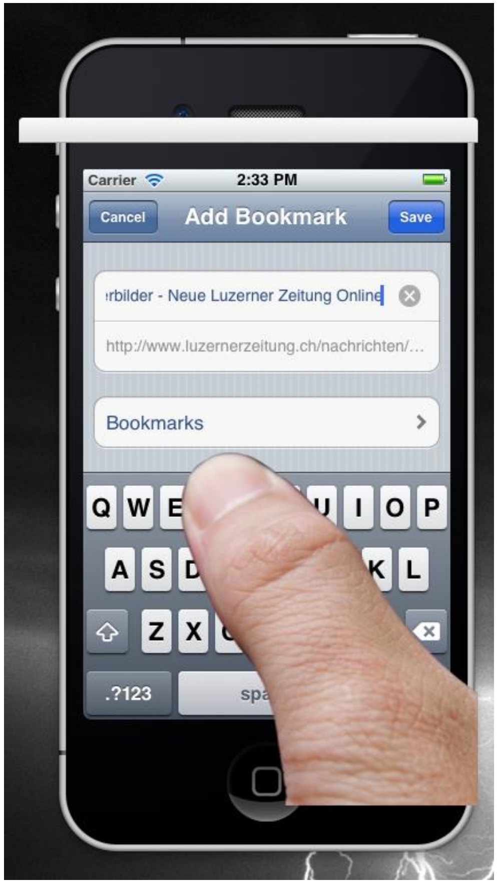
#	Type	Success Criterion	Technique/Step	Level	Description	Tip
1	❗	2.1.1 (automatic)	H91 (Step 2)	A	Number of <A> elements without "title" attribute	Provide a "title" attribute to <A> elements
2	❗	2.1.1 (automatic)	H91 (Step 2)	A	Number of <A> elements without "title" attribute	Provide a "title" attribute to <A> elements

MIS tool

- Simulates visual impairments
- Simulates mobile environment

- https://cent.felk.cvut.cz/hci/accessible/index.php?page=mis





Carrier
2:33 PM
Cancel
Add Bookmark
Save
rbilder - Neue Luzerner Zeitung Online
http://www.luzernerzeitung.ch/nachrichten/...
Bookmarks
Q W E U I O P
A S D K L
Z X C
.?123
spa

Computer vs mobile environment

- Computer
  - Keyboard, mouse
  - Large LCD monitor
  - Steady environment (indoors)
    - Artificial lightning
    - Fixed position
    - Planned activity

- Mobile
  - Touch screen, HW buttons
  - Small display
  - Changing environment (outdoor)
    - Sun, darkness
    - Movements
    - Frequent unpredictable interruption

Simulation of mobile environment in office?

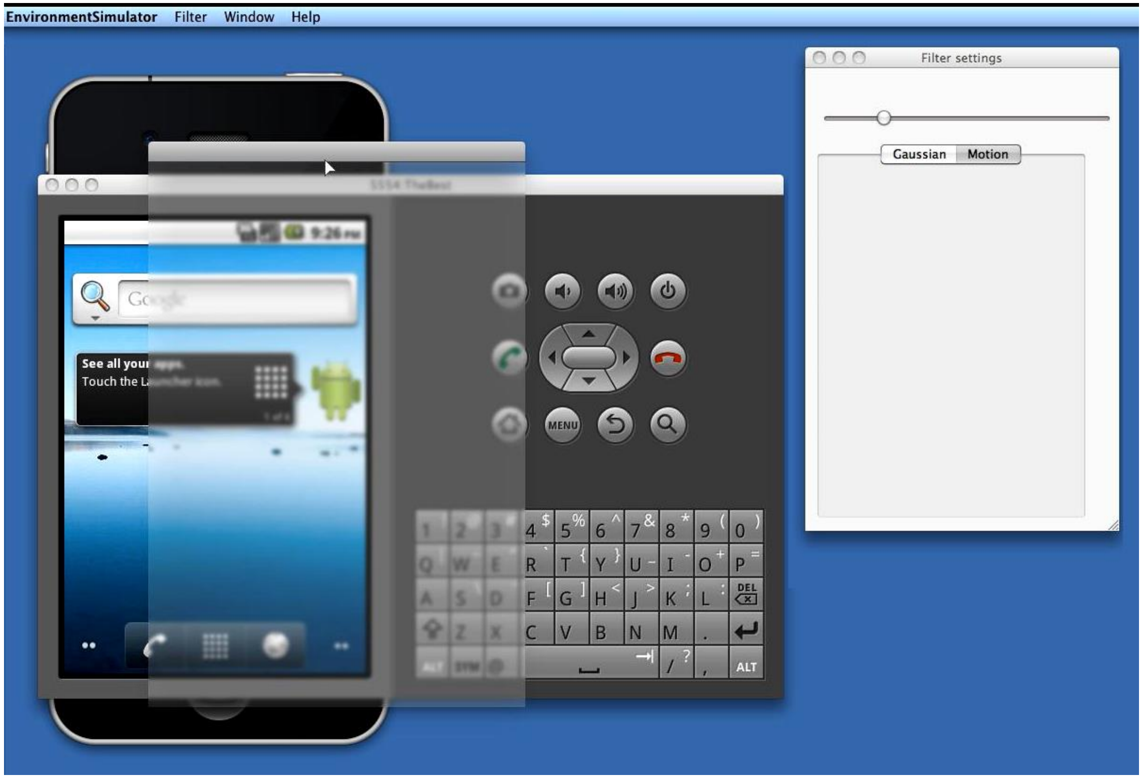
- More factors should be taken into account
- Combination of factors also important
- Difficult to simulate in office environment

Hard to imagine

Simulation desired

Mobile Impairment Simulation tool

- Filter overlay window
- Independent on mobile platform
  - Android
  - BlackBerry
  - iOS
  - Symbian
  - Windows 7
  - …

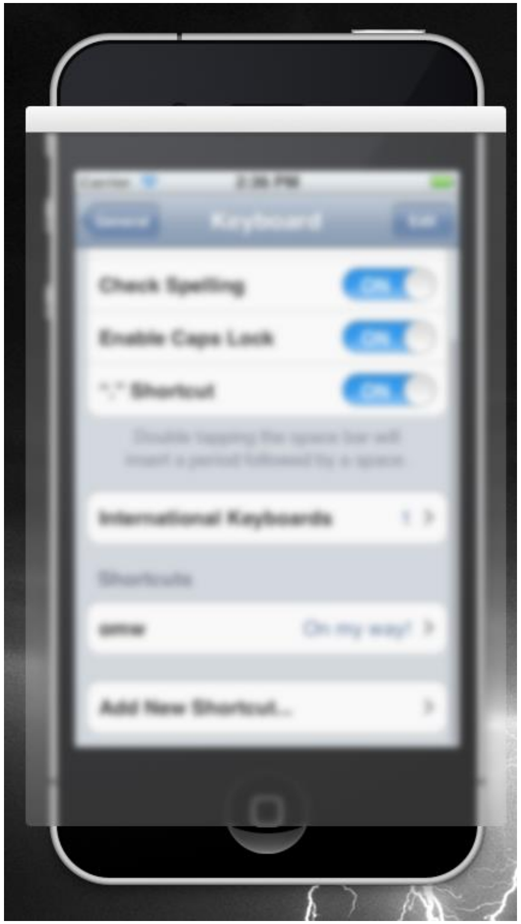


Categories of simulated issues

- Visual impairment
  - Tunnel vision
  - Blurred vision
  - Color blindness
- Occlusion of the display
  - Finger occlusion
- Reflection on the display
  - Static reflections
  - Display tremor
- Combined simulations

Visual impairment

Blurred vision



Carrier 2:36 PM

General Keyboard Edit

Check Spelling ON

Enable Caps Lock ON

“.” Shortcut ON

Double tapping the space bar will insert a period followed by a space.

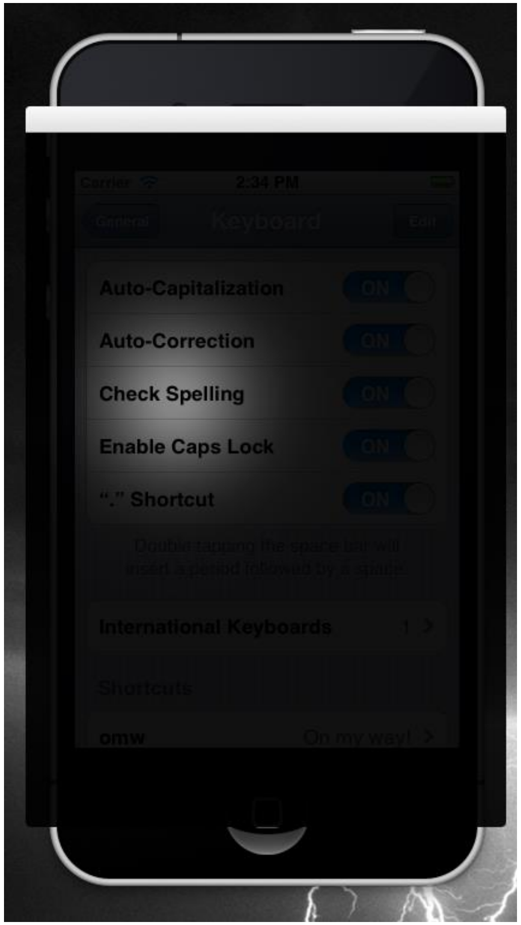
International Keyboards 1

Shortcuts

omw On my way!

Add New Shortcut...

Tunnel vision



Carrier 2:34 PM

General Keyboard Edit

Auto-Capitalization ON

Auto-Correction ON

Check Spelling ON

Enable Caps Lock ON

“.” Shortcut ON

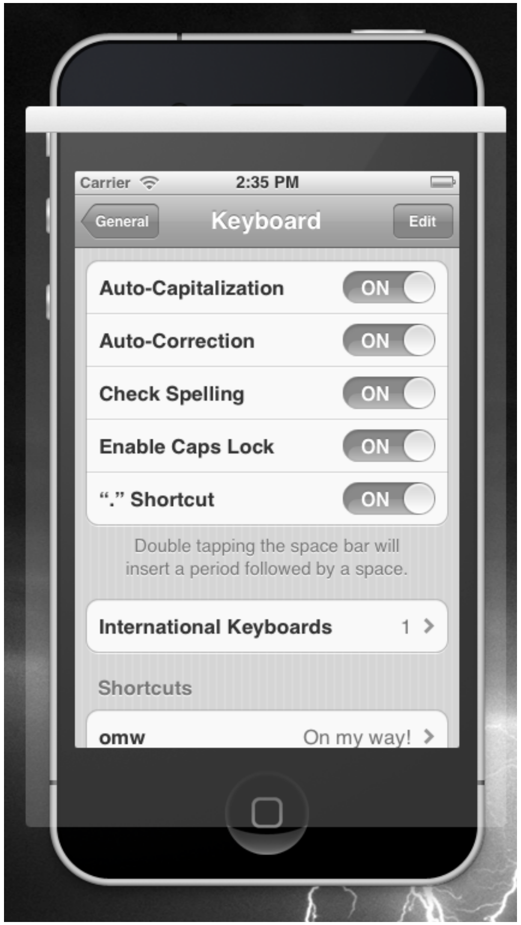
Double tapping the space bar will insert a period followed by a space.

International Keyboards 1

Shortcuts

omw On my way!

Color blindness



Carrier 2:35 PM

General Keyboard Edit

Auto-Capitalization ON

Auto-Correction ON

Check Spelling ON

Enable Caps Lock ON

“.” Shortcut ON

Double tapping the space bar will insert a period followed by a space.

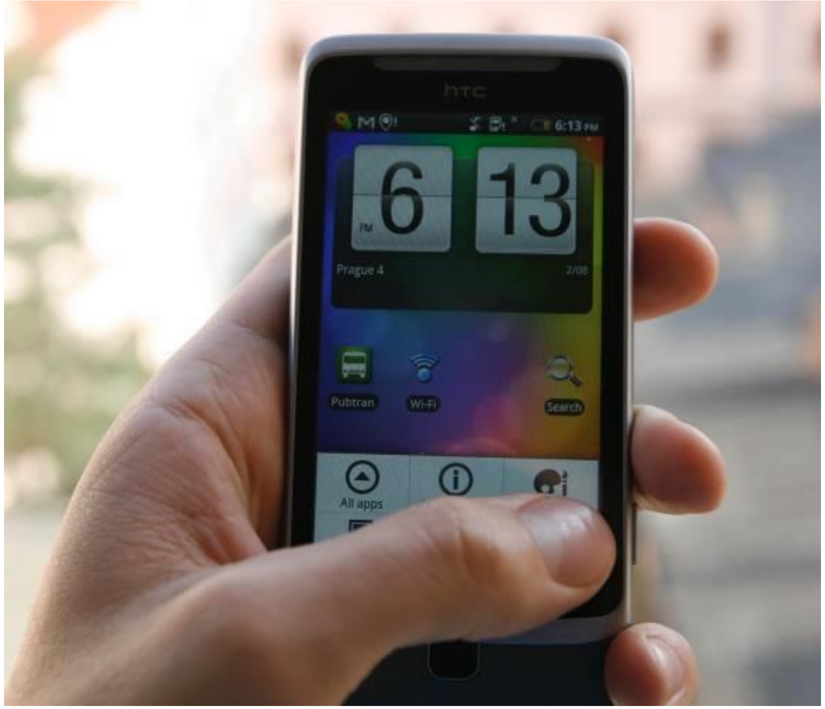
International Keyboards 1

Shortcuts

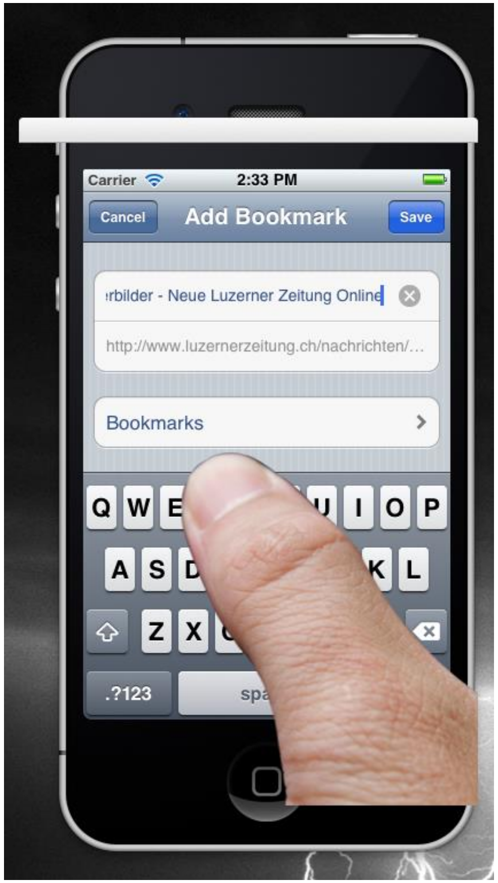
omw On my way!

Occlusion of the display

Real world

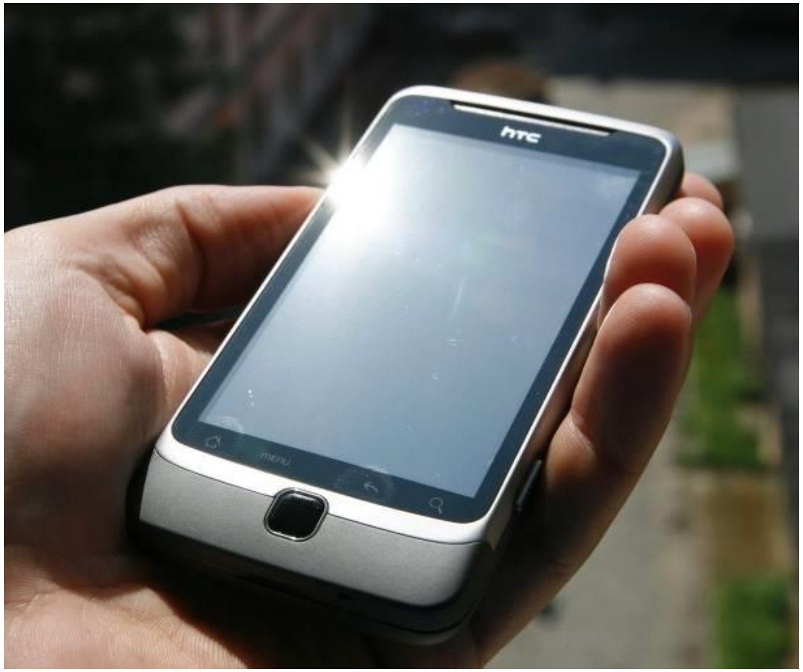


Simulation

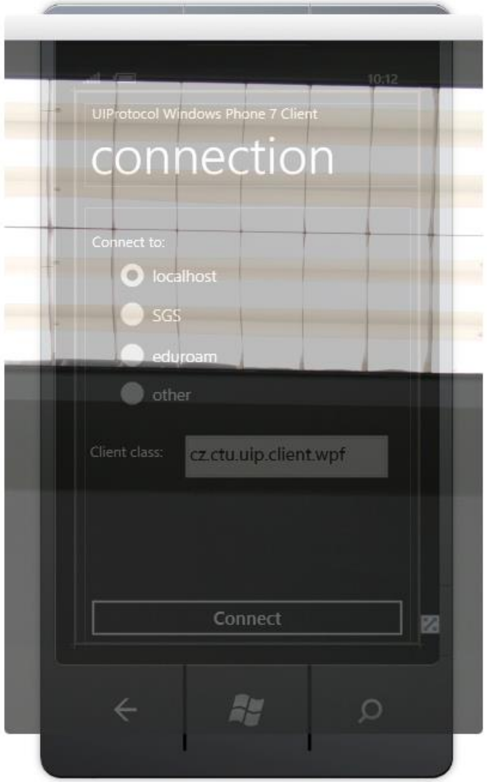

Carrier
2:33 PM
Cancel
Add Bookmark
Save
ırbilder - Neue Luzerner Zeitung Online
http://www.luzernerzeitung.ch/nachrichten/...
Bookmarks
Q W E U I O P
A S D K L
Z X
.?123
spa

Reflection on the display

Real world



Simulation


10:12

UIProtocol Windows Phone 7 Client

connection

Connect to:

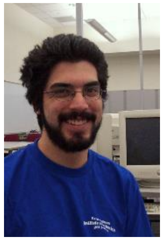
- ● localhost
- ○ SGS
- ○ eduroam
- ○ other

Client class: cz.ctu.uip.client.wpf

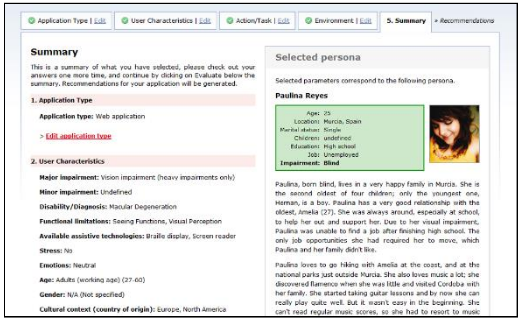
Connect

Development tools supporting accessibility

Development process with a11y support



Developer



Summary

This is a summary of what you have selected, please check out your answers one more time, and continue by clicking on Evaluate below the summary. Recommendations for your application will be generated.

1. Application Type

Application type: Web application

> Edit application type

2. User Characteristics

Major impairment: Vision impairment (heavy impairments only)

Minor impairment: Undefined

Disability/Diagnosis: Macular Degeneration

Functional limitations: Seeing Functions, Visual Perception

Available assistive technologies: Braille display, Screen reader

Stress: No

Emotions: Neutral

Age: Adults (working age) (27-60)

Gender: N/A (Not specified)

Cultural context (country of origin): Europe, North America

Selected persona

Selected parameters correspond to the following persona.

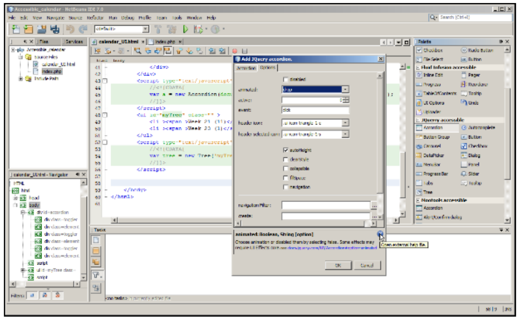
Paulina Reyes

Age: 25
Location: Murcia, Spain
Marital status: Single
Children: undefined
Education: High school
Job: Unemployed
Impairment: Blind

Paulina, born blind, lives in a very happy family in Murcia. She is the second oldest of four children; only the youngest one, Hernan, is a boy. Paulina has a very good relationship with the oldest, Amelia (27). She was always around, especially at school, to help her out and support her. Due to her visual impairment, Paulina was unable to find a job after finishing high school. The only job opportunities she had required her to move, which Paulina and her family didn't like.

Paulina loves to go hiking with Amelia at the coast, and at the national parks just outside Murcia. She also loves music a lot; she discovered flamenco when she was little and visited Cordoba with her family. She started taking guitar lessons and by now she can really play quite well. But it wasn't easy in the beginning. She can't read regular music scores, so she had to resort to music

Accessibility Advisor



ARIA developer

Final applications

Development tools supporting a11y

- AEGIS Accessibility Advisor
  - https://cent.felk.cvut.cz/hci/aegis/public/accessibility-advisor/ (experimental version)
- AEGIS Developer tool
  - https://cent.felk.cvut.cz/hci/aegis/?page=aadt
- SUCESS ARIA Checker
  - https://cent.felk.cvut.cz/hci/coe/?page=aria_checker

Thank you

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