Towards Asynchronous Adaptive Hypermedia

An Unobtrusive Generic Help System

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Contents

• Introduction - Asynchronous Web
• Concepts in Asynchronous Adaptive Hypermedia
• Example System - Providing Help
• Conclusion, Future Research
“Asynchronous” web

Terminology
- Asynchronicity in the context of web refers to the point in time, when the actual data transmission takes place.

Technical aspects
- Asynchronous data transfers take place independently of the traditional, surrounding, blocking http-request-response cycle (out-of-band communication).
- RIA, AJAX, XmlHttpRequest, …
- Many current (widget)-frameworks inherently support this technology.

Benefits
- More responsive interfaces
- More applications are being transferred from the desktop to the web. Gaps must be bridged ASAP (regarding GUI, latencies, features, convenience, etc.)
- ...
traditional “synchronous” apps

asynchronous web apps
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asynchronous web apps
Further examples for async. web apps

- Many Google apps, Yahoo apps, etc.
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Adaptive Hypermedia Systems (AHS)
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- Client
- Data collection
- Models
  - Uses
  - Modelling
- Adaptation engine
  - Apply on data/pages
Adaptive Hypermedia Systems (AHS)

Client

Data collection

- on http-requests
  - all kind of data
  - implicit, explicit.
  - piggybacking of data

Adaptation engine

Uses

Models

Apply on data/pages

Modelling
Adaptive Hypermedia Systems (AHS)

adaptation is applied once

apply on data/pages

data collection

adaptation engine

uses

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modelling
Async. Adaptive Hypermedia - concept

- Combination of the well established field of Adaptive Hypermedia with well-established techniques of the asynchronous web.
- Bidirectional, continuous communication channel! (AJAX’s not enough!)
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apply on data/pages

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Diagram:
- Client
  - Data collection
  - Continuously transmit (usage) data
- Adaptation engine
  - Uses
  - Models
  - Modelling
  - Apply on data/pages
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```
continously update page
"Instant Adaptation"
apply on data/pages
continously transmit (usage) data
```

```
data collection
uses
modelling
```

```
client
adaptation engine
models
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Asynchronous AH - Implications [1]

- *In general:* the more the system knows about a user, the better personalization could be featured.
- More (precise) data about user actions -> more possibilities for interpreting subsymbolic user behavior.
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• **Key Strokes** -> typing characteristics, *adaptive text completion / recommendation*, plan recognition etc.
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- Browser events (scroll actions, etc.) -> focus of attention, etc.
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- “Still Alive / Working / Active” messages
Asynchronous AH - Implications [2]

• **On-demand data retrieval** gets possible -> reduced “provisional transmission”;
Adaptive engine needs information from client -> simply ask for it, NOW, asynchronously
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• **Subscriber model** gets possible -> server subscribes to client values (scrolling state, etc.) -> when value changed -> server gets notified
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- **Instant adaptation** -> instantly apply new adaptations when underlying model gets changed -> **instant forward chaining**
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• **Instant adaptation**

• **New facilities/possibilities for evaluation and esp. meta-adaptivity**
Watch / record / replay / eval. sessions

Client
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Central Monitor
Watch / record / replay / eval. sessions

Client

Central Monitor

server / model / etc.
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Client

Central Monitor
AAHS Example: Adaptive Help Provision

• Asynchronous Adaptive Hypermedia System for Help Provision
  • Generic
  • Context sensitive and insensitive help
• Specific aspects to model (in order provide the shown functionality):
  1. User Idle time
  2. Locus/Focus of Attention (FOA):
    • FOA limited to widgets on page
    • When “using” a widget -> user is probably concentrated on that
    • Not a 100% sure hint -> need to quantify the probability of the correctness of this information
    • The longer an element is focused without interaction, the lower the probability gets that a user is still concentrated on the contents / semantics of that element.
Probability of Correctness for FOA

\[ p_{\text{cor}}(\text{it}_{\text{key}}(U), \tau) = \frac{1}{1 + \left( \frac{\text{it}_{\text{key}}(U)}{\tau} \right)^2} \]
Probability of Correctness for FOA

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\[ p_{\text{cor}}(it\_key(u), \tau) = \frac{1}{1 + \left( \frac{it\_key(u)}{\tau} \right)^2} \]

threshold = 50%

passed seconds since last user interaction took place

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Probability of Correctness for FOA

The probability of correctness is expressed as
\[ p_{\text{cor}}(\text{it}_\text{key}(U), \tau) = \frac{1}{1 + (\frac{\text{it}_\text{key}(U)}{\tau})^2} \]

\[ p_{\text{cor}}(\text{it}_\text{key}(U), \tau) \]

\[ \text{threshold} = 40\% \]

passed seconds since last user interaction took place
seconds for prob = 50% (“stretchfactor”)
Context Sensitive Help [1]

- **Attention Span**
  - Number of seconds a widget is focused and probability of correctness > threshold

- Help is offered/triggered if the attention span on an input element is higher (threshold!) than average.

- If server-side system determines that attention span is exceeded, it sends specific help text to the client, which shows that help text in an unobtrusive way.
configuration

average attention span = 18s
tolerance = 33%
--> offer help after
   24 seconds

Value of $p_{\text{correct}}$ after 12
seconds = 50% -->
   $\tau = 12$

FOA can be determined, if
   $p_{\text{correct}} > 60\%$
configuration

average attention span = 18s
tolerance = 33%
--> offer help after
  **24 seconds**

Value of p_correct after 12 seconds = 50% -->
  \( \text{tau} = 12 \)

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Context **Insensitive Help** [1]

• **Semantics**: Offer help when system notices that user probably needs no specific, but general help (using the system itself, application / domain specific help, etc.)
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- Compare the “progress” of each element on a page with it’s “final state” -> do this for each element -> progress on whole page (0% - 100%)
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- The more interactions a user needs for a certain degree of progress on a page, the higher is the probable “confusion factor” of that particular user -> higher chance to need general help.
Context **Insensitive Help** [2]

- Threshold factor is dynamic and depends on the current progress.
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- Nevertheless, some groups of users orientate first when entering a page -> a certain degree of flexibility must be tolerated from the beginning.
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Goal: support the user!!
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Observe the user’s behaviour (typing speed, mistakes, characteristics, general timings, focus of attention, etc.)
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Data transfers without the user’s awareness.

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Future Work

• **Validation** of shown concepts are currently being prepared.
  • **technical evaluation**: general feasibility and certain aspects (scalability, latencies, browser-independence, etc.) -> stable and reliable technical basis
  • **user-oriented evaluation**: show that AAHS have further impact on the quality
  • **empirical user study** for help system

• Validation -> refinement -> **module for LMS** (assist in self assessments, general platform usage, etc.)

• Many technical improvements possible on the technical side (reducing the amount of transmitted data, bulk transfers, enhanced client logics, etc.)
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• New features, new challenges, new research topics

• Let’s launch Adaptive Hypermedia 2.0!
Thx for the attention!

Questions???

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http://www.als-project.org