Tiers of Web Programming
- case of webOrigami -

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Motivation

- Make available software under development to interested people
  - We may be able to get good feedbacks from users.
  - Giving away programs may not be a good idea.
- Provide the computing services of the software
  - We run a server executing the software and make its service available.
webOrigami project

- Provide the service of computational origami to interested people.
  - limited capability
  - interface more friendly to ordinary people

- Use of webMathematica technology
  - Web browser, JSP (container of Java servlet), Mathematica server
Computation Model for Programming

- Traditional
  - Tree, e.g. Lisp, pure functional program
  - Closure of a tree by environment (i.e. a set of variable-value pairs)
  - Rewriting those expressions by an interpreter
Computation Models for Web Programming

- Players are clients and servers
  - Web browser + web server
  - Web browser + web server + computing server (database server)
  - Script interpreter + web browser + web server + computing server (database server)
- Objects of computation are (XML) trees
Web Programming

- We have to know at least 3 languages
  - XML
  - JavaScript
  - Server side language (Java, C++, Mathematica, php, etc)
- Semantics/Syntax
- Interactions
Tree

- XML tree
- Four kinds of trees
  - Client code tree, JavaScript
  - Server code tree, Java, Mathematica, etc
  - Input form tree, \(<form, \ldots >\)
  - Data tree, \(<table, \ldots >\), \(<div, \ldots >\), etc
Tree (XML) for Computation

Input form

C

P
Processing a Tree

- Trees are rendered (B)
- Trees are scanned (W)
- Trees are rewritten (B, W)
  - By evaluation (in S)
  - By event (mouse click, timer etc) driven evaluation (in C)
  - Synchronously
  - Asynchronously (AJAX)

- Computing states are distributed among the client, web server and computing server
Simple Web Computation

T, T': XML tree
T[u]: XML tree that has u in its node
T.T': a sequence of XML trees consisting of T and T'
S[u']: XML trees that has u' in its node. u' refer to a program
D: the result of the computation by the program
B \[\begin{array}{c}
T[u]
\end{array}\] 
\[T.T'\]

W

\[\begin{array}{c}
S[u']
\end{array}\] 
\[T' = S[D]\]

P

\[\begin{array}{c}
P
\end{array}\] 
\[D\]
C

\[ B \quad T'[\Rightarrow \leftrightsquigarrow \Rightarrow T'' \quad T[u] \rightarrow T.T' \rightarrow T.T'' \rightarrow \]
D' = S[D]
Web Programming in essence

- Design of pages
- Design of algorithms
Languages for Web Programming

- Links, Waitomo
  - new web programming languages
  - Client-side, web server side and computing server side

- Google Web Toolkit
  - Java + RPC (to computing server via web server)
    - Design of interfaces
    - Design of algorithms
  - Generate XML+JavaScript that sit on the browser (B)
Yet Another Language for Web Programming?

- A new language for web programming
  - to facilitate abstract reasoning about computations taking places in all the tiers.
  - required to be compiled to JavaScript and XML

- A formal system to reason about web computing with a language of mathematics similar to term rewriting system is needed.

- For the development of webOrigami system GWT and webMathematica technology is our choice.
Features of webOrigami

- Simple web interface for some features of Eos
- Visualization of origami constructions
- Classical folds and mathematical folds
- 3D and Live3D view of constructions
- Set of auxiliary operations
  - Unfold origami, deleting or duplicating points, rolling back to previous step…
- Origami session management
- Concurrent users management
webOrigami Technology

- **Server side**
  - `webMathematica`
    - `JSP`
    - *Apache web server*
  - `Mathematica kernel`
  - `RDBMS (mySQL)`

- **Client side**
  - `DHTML`
  - `JavaScript`
  - `Java enabled (Live3D)`
webOrigami & webMathematica

1. User sends request to webOrigami server using web browser.
2. webOrigami analyzes request and acquires Mathematica kernel.
4. webOrigami returns proper output using webMathematica.
Current Development

- **Integrating AJAX technology in webOrigami**
  - *Simple version is now at work*
- **Improving website contents and services**
  - More fold methods
  - Reasoning and theorem proving
- **Flash implementation**
  - *Flash 8 Professional (Action Script)*
Summary

- Web programming
  - Four tiers
  - Models of computation
- webOrigami project
  - Tools – GWT, Java development environment (Eclips), webpage designer (DreamWeaver)
  - Formal models
Web programming with tiers (tears)

Web programming with smiles