DYNAMIC MATHEMATICS WITH GEONExt: NEW CONCEPTS

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Project „GEONExT“

Development Since 1997

Geometry
Calculus
Algebra

26 Different Languages

Dynamic Worksheets

> 250,000 Downloads

Evaluation

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Technology: Status Quo

- Programming Language: Java
  - Platform independent

- Execution as
  - Java Application
  - Java Applet
    - Integration into web pages
    - Dynamic worksheets

- Requirements
  - Java supported OS
  - Java Runtime Environment

- Effects
  - Parts of the Java platform are loaded before application/applet starts.
  - Java platform allocates memory.
Dynamic Geometry Software

- First generation (since 1980, at least): Standalone programs
  - Geometer's Sketchpad
  - Cabri
  - Euklid (DynaGeo)
  - Thales
  - ...

- Second generation (since 1996): Programs running in a web browser plugin
  - Java based:
    - Cinderella
    - GEONExT
    - GeoGebra
    - ...
  - Flash based:
    - TracenPoche

- Third generation (now): Web2.0
  - Applications are natively embedded into the web browser
New version of GEONExT: Split up into two projects

- GEONExT²
  - Independent graphical user interface (GUI)
  - Used by teachers and students

- JSXGraph
  - Underlying visualization library
  - Used by GEONExT²
New Technology: Layer Model

- Classroom/Student/Teacher
- DGS
- GEONExt²
- Worksheet Creator
- GEONExt File
- GEONExt² File
- INTERGEO File
- JavaScript Program
- Viewer
- JSXGraph
- JavaScript Engine
- Web Browser
- Web Publisher
### Java vs. JavaScript (GEONExT vs. JSXGraph)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Java</th>
<th>JavaScript</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of executable</td>
<td>Large &lt;= 1 MB</td>
<td>medium 300 kB</td>
</tr>
<tr>
<td>Bandwidth cost</td>
<td>high</td>
<td>low 50 kB</td>
</tr>
<tr>
<td>(&gt;= 1 MB jar file is already compressed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plugin needed</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>Communication App. ↔ Web page</td>
<td>slow</td>
<td>fast (seamless)</td>
</tr>
<tr>
<td>Communication App. ↔ Web server</td>
<td>proprietary</td>
<td>easy (AJAX)</td>
</tr>
<tr>
<td>Execution speed</td>
<td>fast</td>
<td>medium</td>
</tr>
</tbody>
</table>
Technical Realization

- **JavaScript**
  - Supported by all web browsers
  - *Common myth: “JavaScript is slow”*
  - “The worlds most misunderstood language is the worlds most important language” (Douglas Crockford)

- **Vector Graphics**
  - Natively supported by all web browsers
  - No plugin necessary
  - No installation problems
  - SVG: Supported by Firefox, Safari, Opera, Google Chrome
  - VML: Supported by Internet Explorer

- **Other output options (in preparation):**
  - Silverlight-plugin: pushed by Microsoft (works partially)
  - Canvas: Firefox, Safari (iPhone), Opera
  - PostScript, Metapost,...: High quality print output (LaTeX-support)
**jsxgraphcore.js**

- File Size Comparison (in bytes):
  - Original size: 297632 bytes
  - Compressed size: 50427 bytes
  - Savings in bytes: 247205 bytes
- Percentage saved by compression: 84.0%
- Transfer speed improvement: 5.9x
- Dial-up Modem
  - 56.0 Kbps: 41.522 s → 7.035 s

**prototype.js**

- Original size: 124136 bytes
- Compressed size: 28230 bytes
- Savings in bytes: 95906 bytes
- Percentage saved by compression: 78.0%
- Transfer speed improvement: 4.3x
- Dial-up Modem
  - 56.0 Kbps: 17.318 s → 3.938 s
JSXGraph – Fields of Application

- JSXGraph supports/will support:
  - Geometry
  - Calculus
  - Statistics
  - Charts
  - Iterated Function Systems
  - Transformations
At the moment JSXGraph

- displays GEONExT files

- supports the Intergeo file format
- has a programming interface (API), still evolving
JSXGraph

- is open source software (LGPL)
- can be used freely by anybody
  - to publish mathematical content in the WWW
  - to build a DGS

- Visit JSXGraph
  - http://jsxgraph.org
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Web Browser
Associated Projects

- **JSXGraph Worksheet Creator**
  - Web service for creating dynamic worksheets online

- **GEONE\textsuperscript{T}\textsuperscript{2} User Interface**
  - **XUL (XML User Interface Language)**
    - XML based user interface markup language
    - Developed by the Mozilla project (platform independent)
    - Execution with XULRunner
  - HTML-JavaScript based User Interfaces
Thank you for your attention.

Visit our projects:

- http://jsxgraph.org
- http://geonext.de