

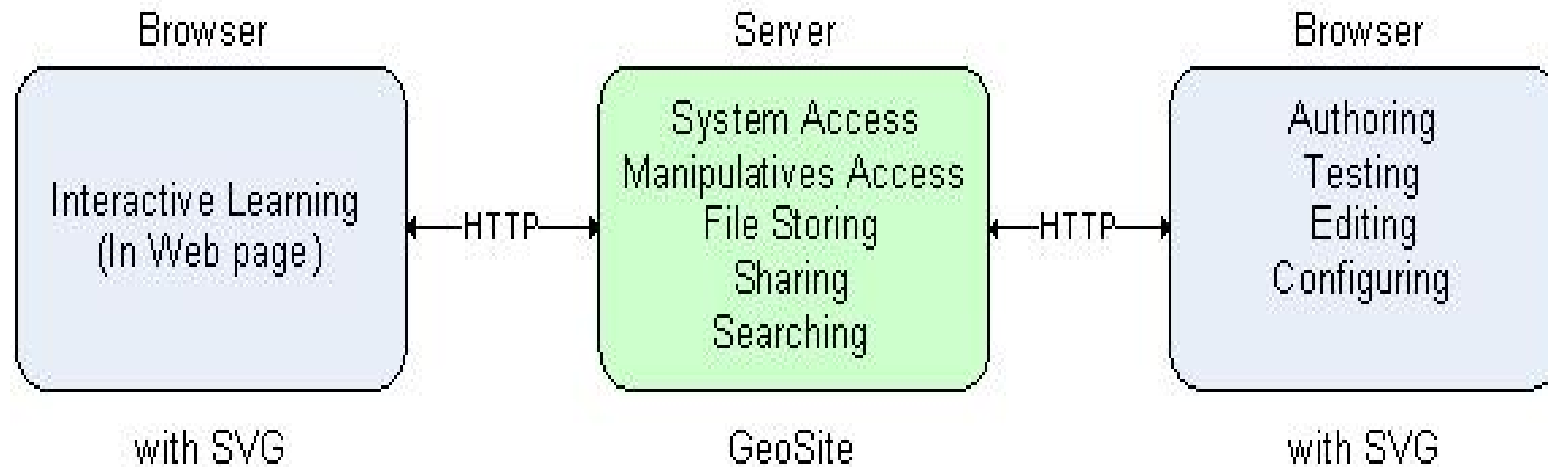
# **GeoSVG and GeoSite**

- a Web-based system for manipulative and  
education page authoring

Xun Lai

Feb. 15<sup>th</sup>, 2006

# GeoSVG Architecture and Components

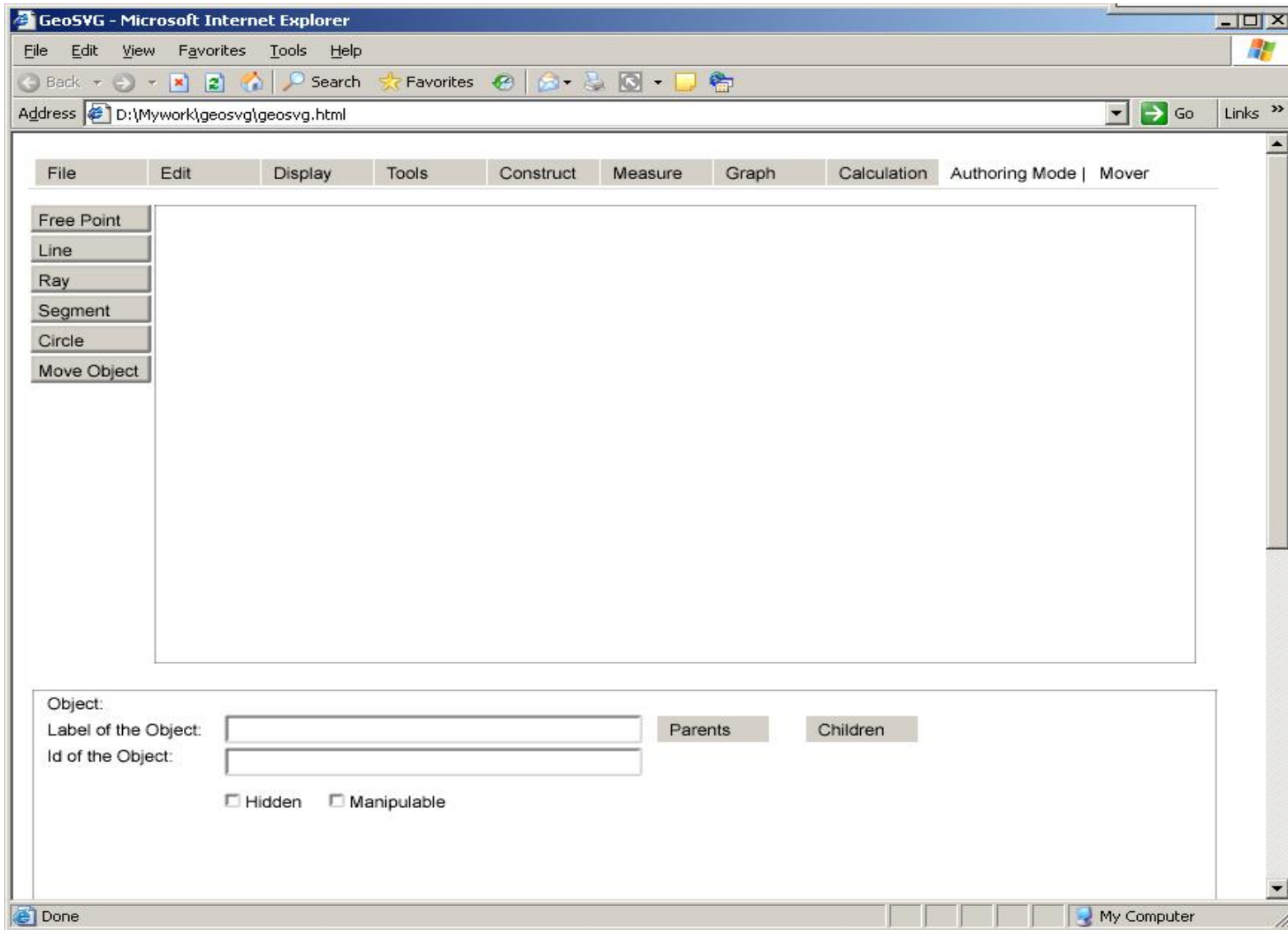


# GeoSVG Architecture and Components (cont.)

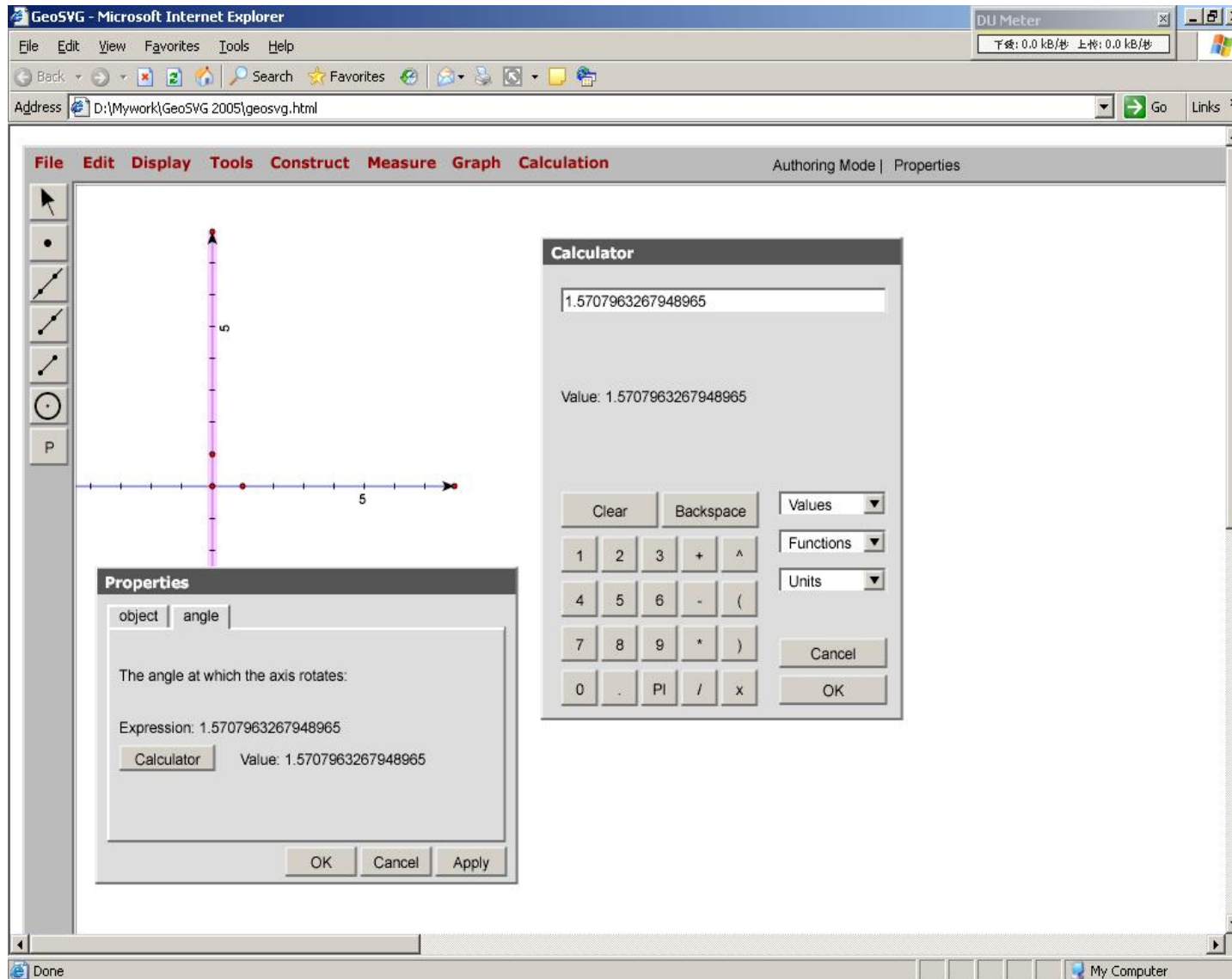
- The GeoSVG toolkit:
  - a. An SVG-coded *Plane Geometry Engine* for authoring and viewing manipulatives (creating, moving, and animating geometric objects).
  - b. GUI for the authoring environment providing authoring logic, a variety of dialogs assisting authoring, publishing, and communications with the server side.
- The GeoSite (<http://wme.cs.kent.edu/geosite/main.html>): a Web site that makes the GeoSVG toolkit available as well as stores manipulatives and education pages for access, searching, and sharing.

# GeoSVG Toolkit for Manipulative Authoring

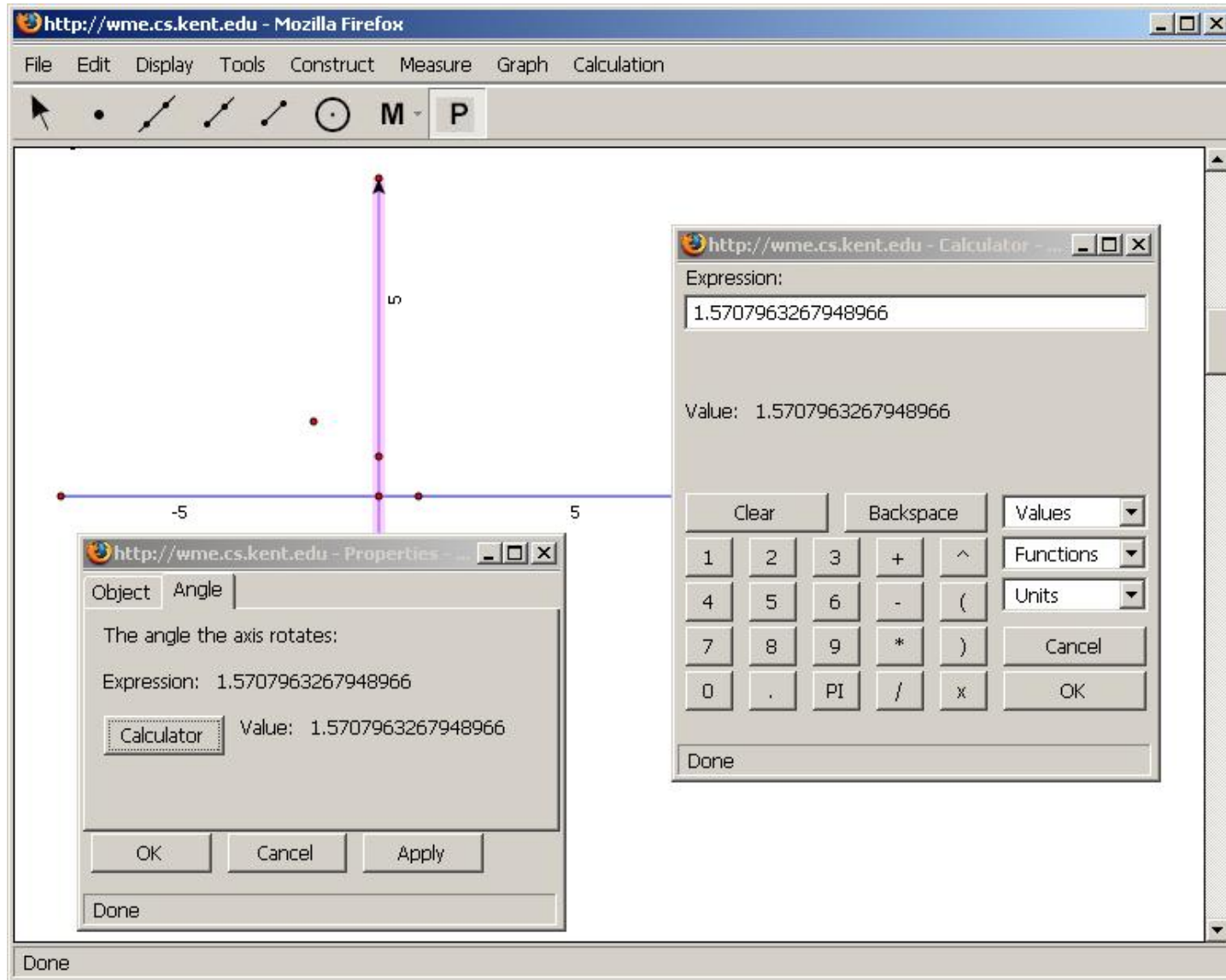
- Using Firefox for running the GeoSVG toolkit
  - Native SVG support
  - Native MathML support
  - XUL for rapid application development
  - Inter-document communication among SVG, XHTML, MathML, and XUL
  - Cross-platform: Windows, Mac and Linux



**Previous version under ASV**

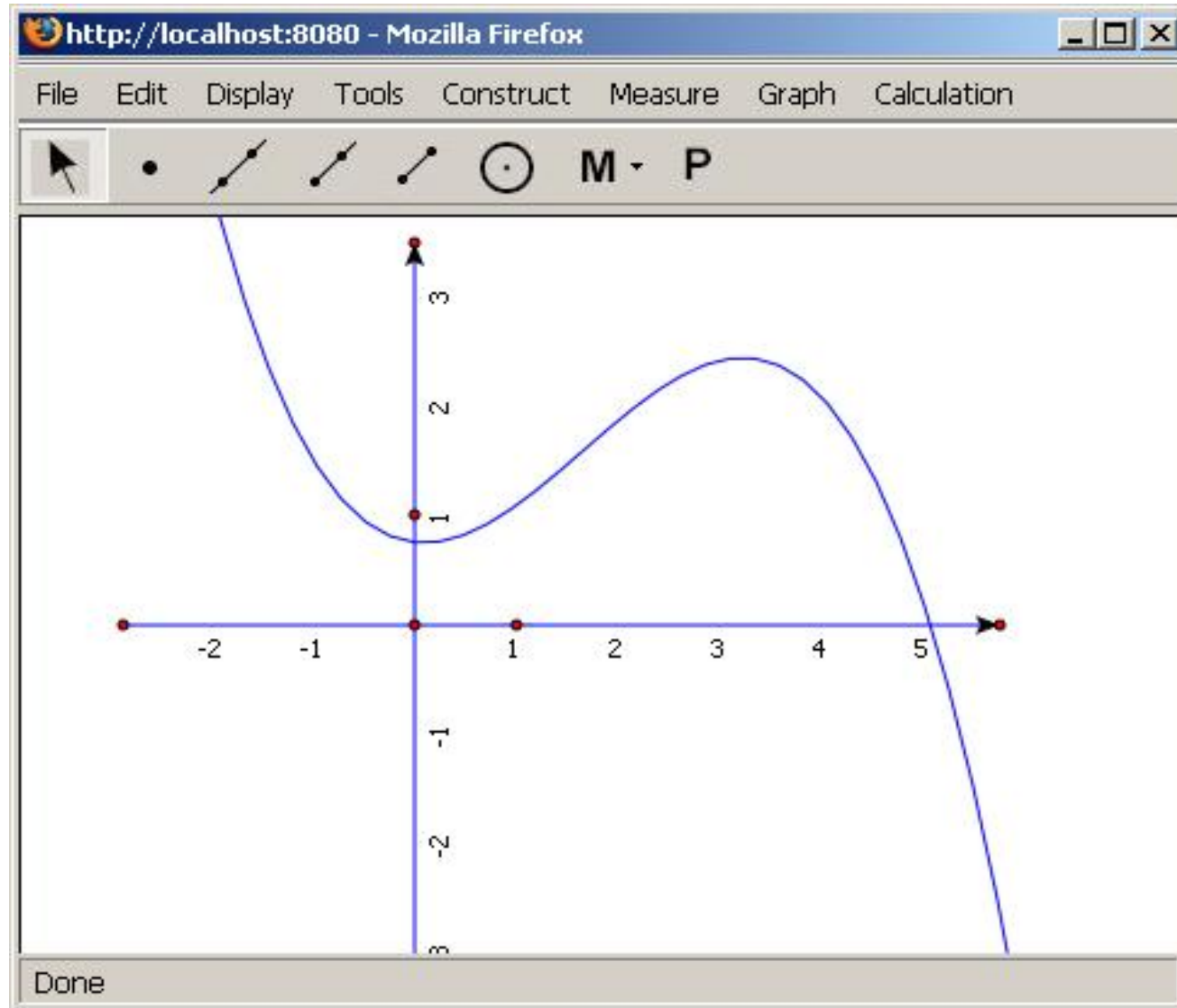


**Previous version under ASV**



**Current version under Firefox**

# Manipulative Authoring Environment





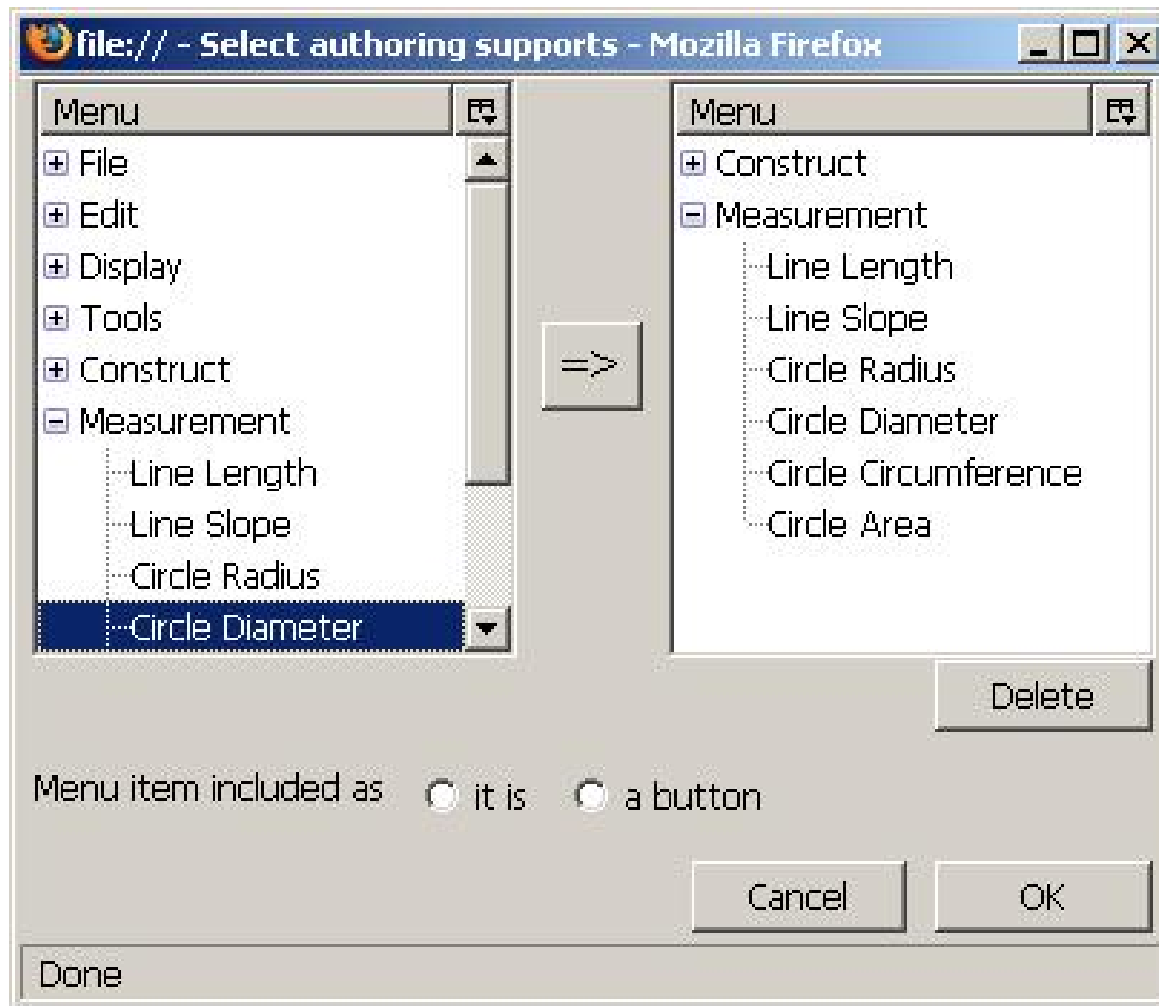
# Complete Web Orientation

	<b>Traditional DGS System</b>	<b>GeoSVG</b>
<b>Software installation</b>	Per Computer installation required	Use through browser, no installation required for authoring or learning
<b>Manipulative sharing</b>	Difficult because manipulatives are stored on individual computers	Easy because manipulatives are stored and searchable on the Web
<b>Publishing manipulatives</b>	Authors need to include Java applets in Web pages which are then deployed on servers	Saving a manipulative automatically publishes it on the Web
<b>Download speed</b>	Applets are binary, large and slow to download	Files are textual, smaller and can be compressed for fast download
<b>Open Standards</b>	Use proprietary technologies	Use W3C standard Web technologies
<b>Interoperable with the enclosing page</b>	No	Can be driven by data outside, and output data

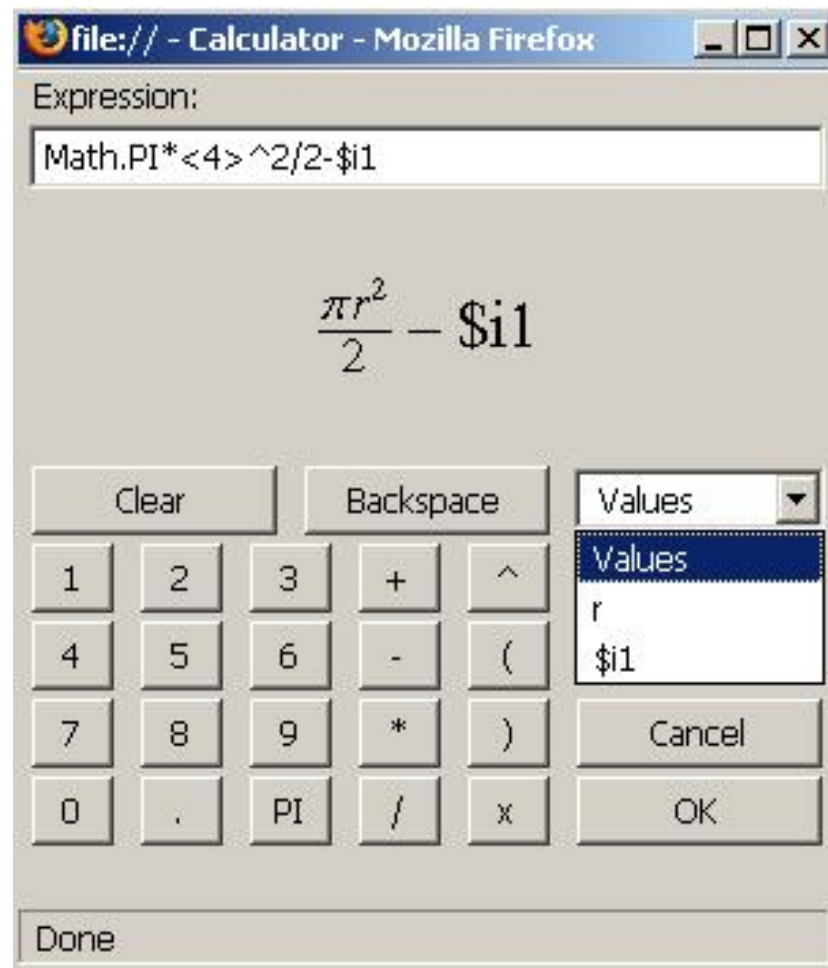
# Manipulative Enhancement by the Web

- Flexible authoring support in a manipulative (next slide)
- Input and output interface of a manipulative
- Page composition with answer checking
- Submittable manipulative
- Keywords and search

# Flexible authoring support in a manipulative



# Dynamic Calculator – the bridge connecting manipulatives and the enclosing page



# GeoSite

The screenshot shows a Mozilla Firefox browser window titled "GeoSite - tester1 - Mozilla Firefox". The address bar displays "http://localhost:8080/ge". The page header includes the "GeoSite & GeoSVG" logo and a welcome message for "tester1", with links for "My Folders", "My Account", and "Log Out".

The main content area is titled "Plane Geometry" and features a table of manipulatives. Above the table are buttons for "New Manipulative" and "New Folder". Below the table are buttons for "Edit", "Configure", "Manipulate", and "Remove".

On the left side, there are several utility sections:

- My folders:** A list of folders including Algebra, Percentage, Plane Geometry (highlighted), and Integral.
- User you want to visit:** A text input field and a "GO" button.
- Search:** A text input field and a "Search" button.
- Most visited manipulatives:** An empty section.

The status bar at the bottom of the browser window shows "Done".

<input type="checkbox"/>	Name	Author	Date Modified	Size
<input type="checkbox"/>	<b>Triangles</b>	<b>tester1</b>	<b>Dec. 19, 2005 2:21 PM</b>	
<input type="checkbox"/>	Area of a circle	tester1	Dec. 22, 2005 4:29 PM	1K
<input type="checkbox"/>	Construct a triangle	tester1	Dec. 21, 2005 1:30 AM	4K
<input type="checkbox"/>	tester2's submission	tester2	Dec. 26, 2005 1:00 AM	4K
<input type="checkbox"/>	tester3's submission	tester3	Dec. 28, 2005 10:23 AM	4K
<input type="checkbox"/>	Parallelogram	tester1	Dec. 22, 2005 4:29 PM	4K
<input type="checkbox"/>	Trapezoid	tester4	Dec. 27, 2005 11:44 AM	2K

# Education Page Authoring

- A page consists of sections and manipulatives
- Manipulative
  - Output interface: output data used by sections
  - Input interface: driven by sections
- Section: text, quantities, inputs, and buttons
  - Quantities and buttons defined by the dynamic calculator
  - Output interface: some quantities and inputs
  - Input interface: some quantities

# Education Page Authoring: Manipulative and Section

The screenshot shows a Mozilla Firefox browser window titled "GeoSite - tester1 - Mozilla Firefox". The address bar displays "http://localhost:8080/geositeWithM". The page content is titled "Area of a Circle" and features two buttons: "Define Output Interface" and "New Question".

On the left side, there is a "My folders" sidebar with the following items:

- Algebra
- Percentage
- Plane Geometry**
  - Triangles
  - Area of a circle
  - Construct a triangle
  - Parallelogram
  - Trapezoid
- Integral

Below the sidebar, there is a "User you want to visit" section with an input field and a "GO" button, and a "Search" section with an input field and a "Search" button.

The main content area displays a diagram of a circle with a radius of 1.25. The radius is represented by a blue line segment from the center to the circumference. Below the diagram, the text "Radius= 1.25" is shown.

Below the diagram, there is a question: "1. The measured radius of the circle is 1.25. Please calculate the area of a semi-circle:  Check it".

The status bar at the bottom of the browser window shows "Done".

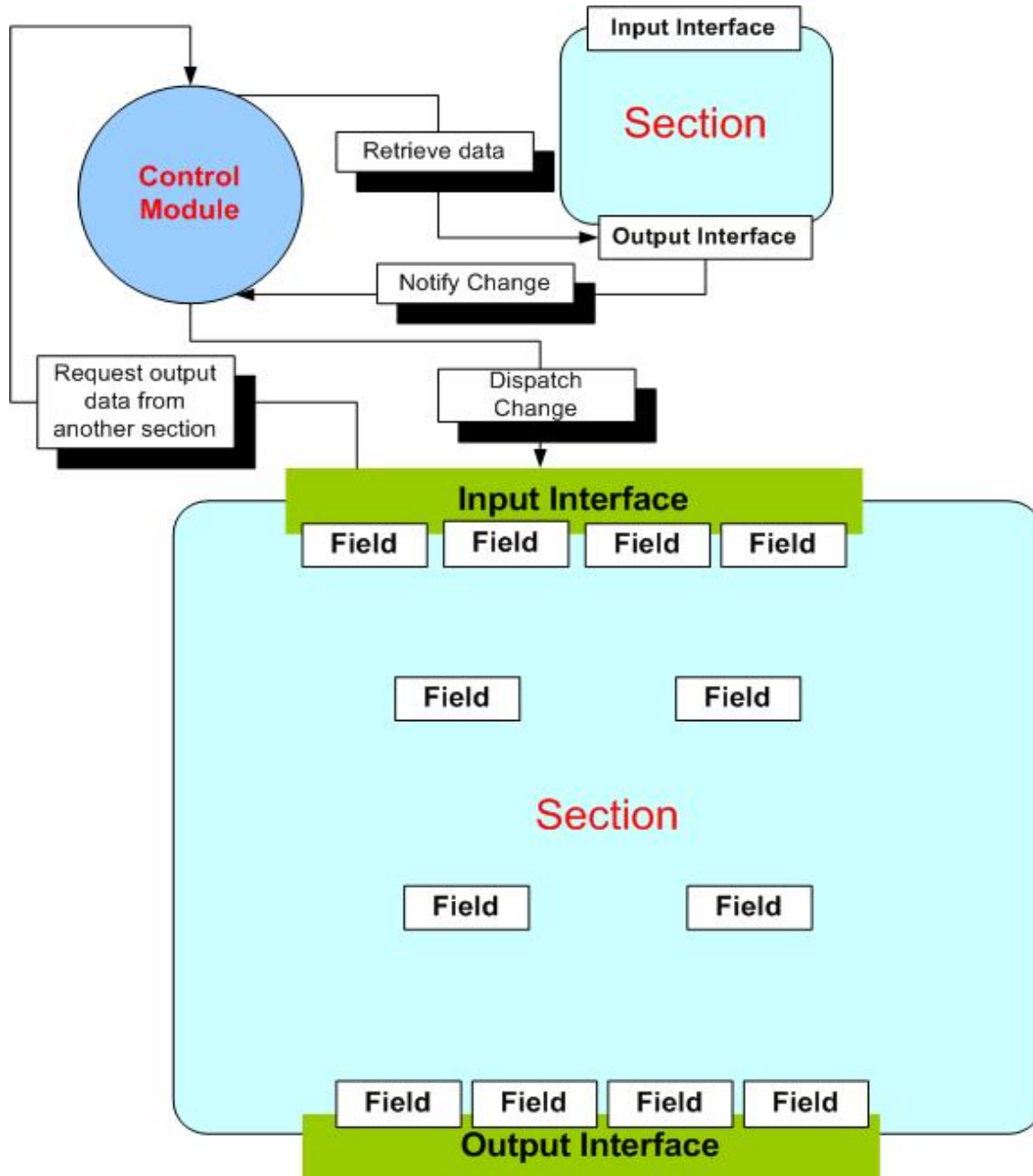
# Hands-on

- URL: <http://wme.cs.kent.edu/geosite/main.html>
- Username: type the username you want to use on the left sidebar
  - tester1
  - paul
  - michael
  - adnan
  - saleh
  - cem
  - xiao
- Just for demo: no error checking for wrong username, wrong manipulative URL, strange characters in section composition



# Analysis of Section and Manipulative Structures

- *Input Interface*: fields that are totally or partially determined by data outside
- *Output Interface*: fields whose value can be retrieved by outside
- *Internal fields*: fields that are totally determined by other fields in the same section, and cannot be seen by outside



# Analysis of Section and Manipulative Structures (cont.)

- Fields in input interface, internal fields, and fields in output interface form a DAG (directed acyclic graph)
  - Fields in three domains (input/internal/output) may depend on each other. It's not necessary that internal fields depend on output interface fields, and input interface fields depend on internal fields. So
  - Updates of fields may not be executed in the order of  
input interface → internal fields → output interface
  - Breadth First Search (BFS) is needed to do the updates.
  - Author of manipulatives/sections must be careful enough to not allow fields to form a loop
    - GeoSVG: detect dependency loop of geometric objects
    - Section composition: detect loop created by the dynamic calculator

# Analysis of Section and Manipulative Structures (cont.)

- All the sections/manipulatives also form a DAG
  - If one input interface field of section1 depends on one output interface field of section2, we say section1 depends on section2.
  - The page authoring algorithm must not allow sections/manipulatives to form a loop of dependency
  - It's not good to force a page author to compose sections with dependency in the order of their appearance.
  - BFS needed.

# Analysis of Section and Manipulative Structures (cont.)

- Consider reusability of a section/manipulative in another page, we need to divide the expressions created by the dynamic calculator into two types.
- Expression attached to a field
  - page specific: expressions attached to input interface fields
    - Saved separately from the section/manipulative
  - class-wide: expressions attached to internal fields
    - Saved together with the section/manipulative

# **Analysis of Section and Manipulative Structures (cont.)**

- SVG, Java applets, Flash based manipulatives need to notify the control module that its loading is done before the control module continues to render next section/manipulative.
- Manipulative development specification

# Editors

- Editor for MathML in dynamic calculator
  - Javascript and MathML converter
- Html editor for composing education page
  - <http://www.dynarch.com/projects/htmlarea/>
  - Good Open Source HTML editor you know

# Future Work

- Based on the demos, work out a robust implementation of page authoring.
- Continue to work on GeoSVG manipulative authoring supports.
- Design GeoSite Web service to allow other sites to retrieve manipulatives together with sections.