A Platform for the Development of Mathematical games on Silverlight

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What is “SLGeometry”

• Developed at the Faculty of Sciences, Novi Sad
• Stands for “Silverlight Little Geometry”
• A platform for developing dynamic geometry applications, interactive math games, demonstrations, teaching materials etc.
• Open-source project, under development, C# project
• Runs as a Silverlight applet or as a desktop application
• Interpreted functional input language
• Visual objects are represented by functions
• Dynamic evaluation of functions causes dynamic screen updates → dynamic geometry!
References

• D. Radaković, Đ. Herceg, Proširiva modularna platforma za dinamičku geometriju, 12 Srpski matematički kongres, Zbornik radova – Sekcija VI, Novi Sad (2008), pp. 185-194


• D. Radaković, Đ. Herceg, M. Löberbauer: Extensible expression evaluator for the dynamic geometry software Geometrijica, PRIM 2009, Novi Sad (2010), pp. 95-100

Summary

• Motivation
• Overview of SLGeometry
• Visual controls
• Demo
• Conclusion
Motivation

• Develop a component-based dynamic geometry system
• Easy integration into other projects
• Improve some of the best features of other DGSs
• Extend existing expression syntax (particularly from GeoGebra) by implementing OO-like syntax
• Simple extensibility model for adding new functions and new visual components
• Import of Silverlight-compatible user controls
Advantages of OO-like syntax

- Improved readability
  - `Point.X` instead of `X(Point)`
  - `Segment.Midpoint` instead of `Midpoint(Segment)`

- Reduced number of specialized functions
  - `Clock.Hour` better than `Hour(Clock)`

- Intuitive – first specify object, then its property
  - `Segment.Midpoint` → evaluates to a point in plane
  - `Segment.Midpoint.X` → evaluates to a number

- Analogy to mobile phones:
  - First choose a contact, then phone no., address, etc.
Components of “SLGeometry”

- Parser – Coco/R
- Expression evaluator
- Graphical subsystem (GeoCanvas + visual objects)
- External functions and Controls from DLL files
Authoring a visual control

- Design the new control in Expression Blend or Visual Studio
- Compile the DLL
- Copy the DLL file to the Web Server
Importing the DLL

- Specify the DLL(s) to be imported in the Web page that runs SLGeometry applet

```xml
<object data="data:application/x-silverlight-2," type="application/x-silverlight-2"
  width="100%" height="100">  
  <param name="source" value="ClientBin/TestApp01.xap"/>
  <param name="onError" value="onSilverlightError" />
  <param name="background" value="white" />
  <param name="minRuntimeVersion" value="4.0.50826.0" />
  <param name="autoUpgrade" value="true" />
  <param name="InitParams" value="LoadDLL=SLGeometryCtl32.dll" />
  <a href="http://go.microsoft.com/fwlink/?LinkID=149156&v=4.0.50826.0" style="text-decoration:none">
    <img src="http://go.microsoft.com/fwlink/?LinkId=161376" alt="Get Microsoft Silverlight" style="border-style:none"/>
  </a>
</object>
```
Using the imported controls

• New functions are defined automatically for all imported controls
• Properties of controls are mapped to the named “properties” of the functions
• Dynamic binding is possible -> animation!
Demo

- Clock
- CheckBox
- PushButton
- Sequencer
- LightBulb
- GeoMap
Benefits

• Rich visual experience
• Interactivity
• Reusability
• Portability (just copy the DLL and the applet)
• Integration with the dynamic expressions
• Components with state enable us to develop “sequential” behavior, in contrast with the “straightforward” dynamic behavior
• Inexperienced users can use advanced components in their drawings!
Disadvantages

- Programming skills needed to develop controls
- Programming tools (Visual Studio, Blend) necessary
- DLL files must be hosted on the Web server
Comparison to GeoGebra tools

• GeoGebra Tools are simpler to use, but not as powerful
• GeoGebra Tools are packed inside .ggb files
• SLGeometry components are in separate .dll files
• GeoGebra Tools create many object each time they are used
• Each SLGeometry component is a single object
Who will use components?

• Programmers and designers will make them
• Users of SLGeometry will download DLL files and use the components in their drawings
• Project source code (under development)

http://sites.dmi.pmf.uns.ac.rs/personal/hercegdj/geometrijica/
Conclusion

• Our goal was to provide easy extensibility and rich interactive controls
• Functions and visual objects are packed into libraries and registered at runtime
• The result is an modular and easily extensible dynamic geometry software
Thank you!