S3402: Mobile Apps with VES
Kitware, Inc.
Outline

- Motivation and Inspiration
- Demonstration
- Capabilities
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  - Application support
  - Client/server communication
  - Build system
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Motivation and Inspiration

- Enable scientific visualization with access to
  - *remote*: data, rendering, and collaborators
  - novel modes of interaction
- Efficient and flexible data structure for rendering
- Comprehensive asset management; not just geometry but everything to describe application data & rendering pipeline
Apps & Platforms

- We develop applications for clients but open-source the framework and an example app
  - Kiwi Viewer
  - Others

- Platforms
  - Android, iOS
  - QNX, Meego

- OpenGL ES 1.0, 2.0, and Desktop OpenGL
Live Demonstration

- Point Cloud Library streaming from Kinect to iPad
Video Demo (Time series animation)
Library Architecture

Application

Kiwi Library

VES Library

VTK Libraries

OpenGL/ES
VES (Scene graph)

- Lightweight scene graph; few classes, simple API, minimal management
- `vesObjects` managed by `shared_ptr<>`
- Nodes provide means to define spatial and logical relationship between scene entities
- A node can only have one parent but many children (this uniquely defines its position in the graph)
VES (Scene graph)

- **vesActor** is a special node to which rendering assets are attached (e.g., holds geometric primitives)
- **vesCamera** is a node that provides model and projection transforms & a viewport to the underlying scene
- A scene can contain multiple cameras which enables applications to perform rendering operations such as multi-pass rendering
VES (Scene graph)

- Visitors traverse arbitrary subgraphs for rendering (used by `vesRenderer`)
- State is managed, but not tracked or optimized.
- Three-pass rendering: update, cull, & draw
VES (Scene graph)

- Each vesNode has a vesMaterial with multiple vesMaterialAttributes (textures, shader, ...)
- Custom or VES-provided shaders (Gouraud, Blinn-Phong, toon).
- Shader uniforms bound via vesUniform.
- Engine uniforms provide useful data to the shaders such as point size, line width, etc.
- Consistent & simple API for vertex attributes
VES (Geometry data)

- Support for interleaved or separated arrays
- Point data may have any dimension (limited only by rendering API)
- Point data (vertex attributes) only; OpenGL/ES 2 does not allow cell data.
- Support for different basic types for the point data (int, float, short, etc..)
Kiwi (Application support)

- Abstract platform APIs (e.g. multitouch gestures)
- Provides widgets, pre-packaged subgraphs for rendering data, bridge to VTK
- Provides application framework and non-visual support functions (server communication)
- On demand or continuous rendering
Kiwi (Application support)

- `vesKiwiDataRepresentation` bundles geometry, per-primitive data, transform, shaders;

- `vesKiwiWidgetRepresentation` allows representations to consume touch events based on context
Video Demo (Picking your brain)

Data credit: SPL/PNL Brain Atlas
http://www.spl.harvard.edu/publications/item/view/1265
Kiwi (Application support)

- Client/server (MIDAS, DropBox, PCL, ParaViewWeb)
  - “Passive” remote data access via MIDAS or DropBox; zip archives with simple JSON manifest.
  - Streaming data from the Point Cloud Library
  - Geometry and/or images from visualization server (ParaViewWeb)
Video Demo (ParaView Remote Control)
Build System

- CMakel-based “superbuild” for libraries; system tools (e.g. Xcode, ant) for apps.
- Build source and all dependencies targeting each of:
  - host,
  - device, &
  - simulator
- Allows unit/regression tests on host.
- Android, iOS, etc. share all but platform-specific UI code.
Performance

Measurements made on iPad3
Holes

- Better configuration/customization of widgets in the scene
- More widgets
- Text rendering
Wiki: http://www.vtk.org/Wiki/VES

Mailing lists: http://public.kitware.com/cgi-bin/mailman/listinfo/ves

Doxygen documentation: http://public.kitware.com/ves-docs

Nightly testing: http://open.cdash.org/index.php?project=VES
Demonstration
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