Kitware

ParaViewWeb, a web framework for 3D visualization and data processing

Freiburg, Germany, 29 July 2010
IADIS - MCCSIS - WEB3DW
Sebastien Jourdain @ Kitware.com

Outline

- Goals
- Main difficulty
  - How we solved it ?
- ParaViewWeb
  - What for ?
  - How does it work ?
- What is available today and tomorrow
- Conclusion

Goals

- Collaborative visualization
  - ✓ ***join*** a running visualization and ***share*** the same ***viewpoint*** and ***processing pipeline***
- Ease access to large infrastructure and data
  - – Large dataset (Giga to Peta file size)
  - – HPC processing capability in the data analysis
  - ✓ access through standard ***Web*** browser
- Flexible enough to be able evolve with the technologies and the standards
  - ✓ Must work ***today*** and ***tomorrow standards***

HTML 5/WebGL and geometry streaming

How to bring 3D to the web

- Via Plugins
  - Flash
  - Java Applet
  - VRML, X3D, Collada, o3d
- HTML5
- ***Something else ?***

How to handle large data ?

(Several Giga Bytes)

How we solved those issues

- Server side rendering
  - Only image delivery to the Web client
- No plugin mandatory
  - Full JavaScript implementation
  - But Java or Flash can be use for better performances

ParaViewWeb

- Open Source web framework
  - Deliver interactive 3D web content
  - No plugin is mandatory
  - Compatible with any browser (except lynx ;-)
  - No hardware constraint on the client side
  - Can be integrated in any existing web site
    - JavaScript or Flash or JavaApplet or a Mix
  - Can be used for collaborative 3D visualization

What ParaViewWeb is good for ?

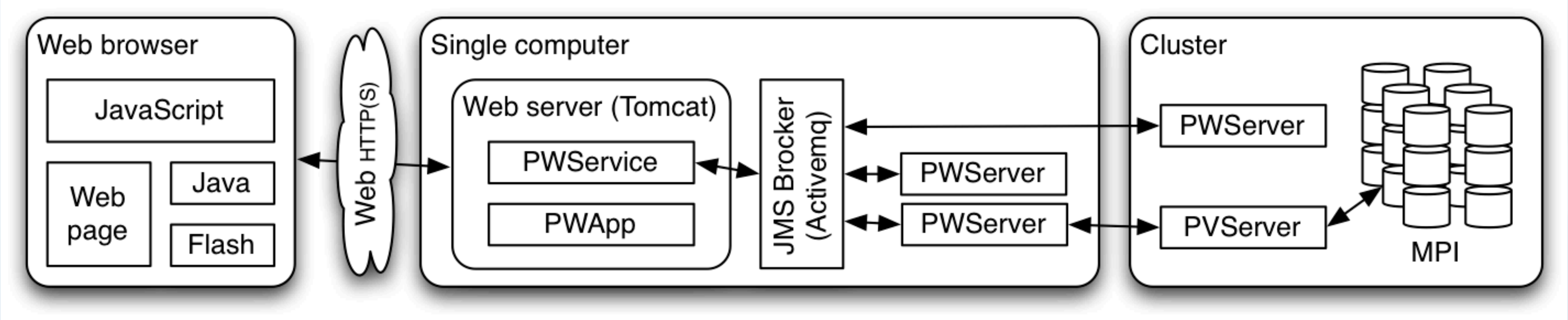
- Access and visualize remote 3D data
  - VRML, OBJ, PLY, VTK, EnSight, DICOM, MHA…
- Process and visualize large 3D dataset
  - The rendering and processing can be done on clusters
- Ease access of complex infrastructure
  - Simply go to a web page from any computer
- Collaboration
  - Several web client can share the same session. (data processing and viewpoints)

How ParaViewWeb works

- It is based on server side rendering and image shipping in an interactive manner
- It is composed of 3 components
  - JavaScript library used in the browser to use the service
  - The web service that allow the user to create remote visualization session, data processing and ship images to the client in an efficient manner.
  - The application where the processing occurs which use ParaView as a backend.

Architecture

- JavaScript library + Renderer (JS/Java/Flash)
- Web service (JSON-RPC + HTTP)
- Processing and Rendering engine
  - Allow multi deployment configuration (local, remote, distributed)



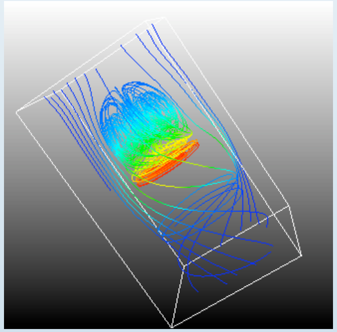
What has been achieved so far ?

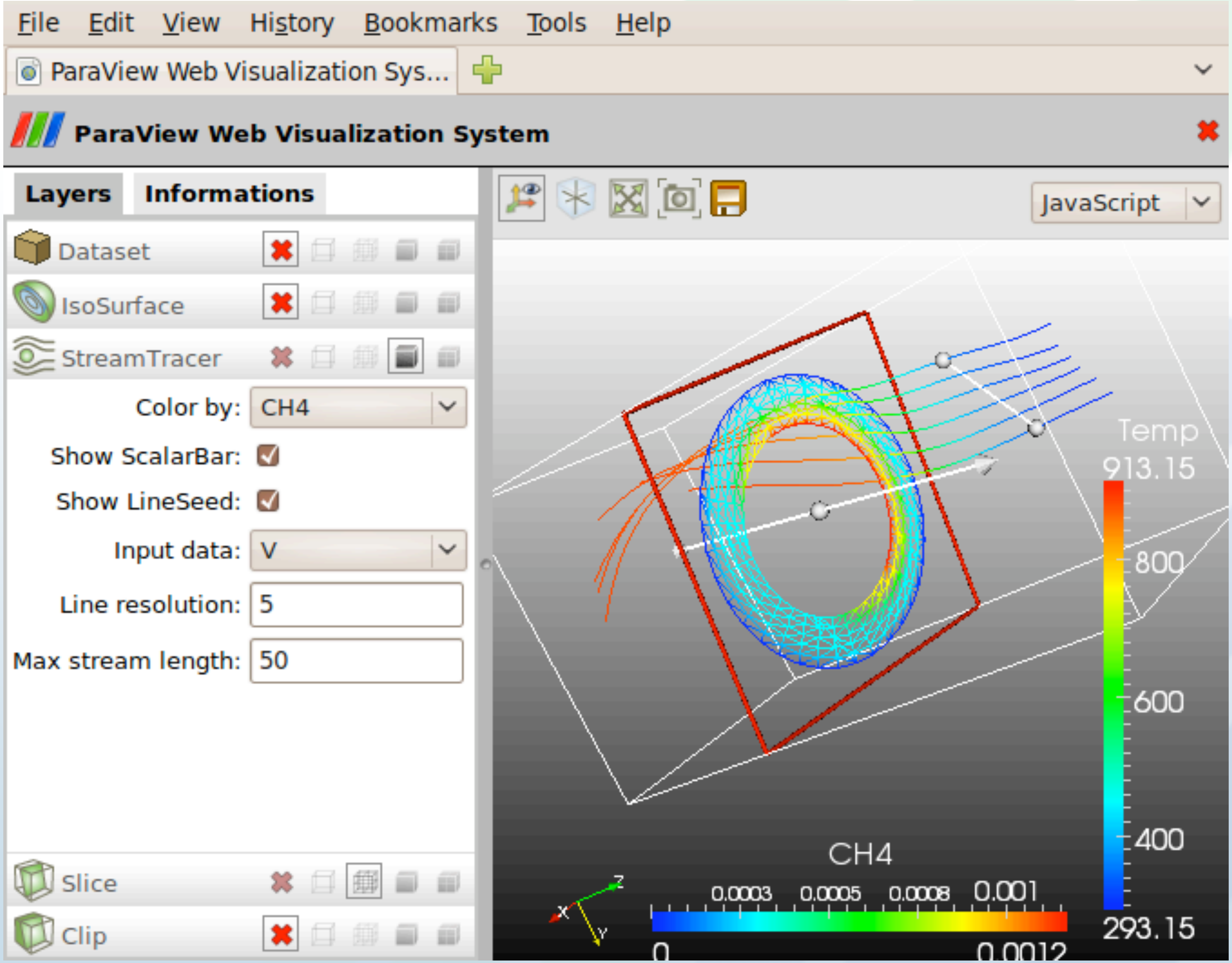
- Set of custom applications
  - Fully featured Web application
    - Demonstration application for scientific visualization and data processing
    - Flow stream analysis along the space shuttle
    - Navigation in a 3D world with ray-casting rendering
  - Sample applications for learning purpose
    - Sandbox, Interactive JavaScript console...
  - Real world integration
    - MIDAS an online database will use it to visualize server data inside their web pages in 3D
    - the next EnVision* will use ParaViewWeb as engine

**EnVision is made by Texas Advanced Computing Center and will use TeraGrid*

Scientific visualization

- Local and remote data loading
- Remote connection
- Data processing





Color by: CH4

Show ScalarBar: ☑

Show LineSeed: ☑

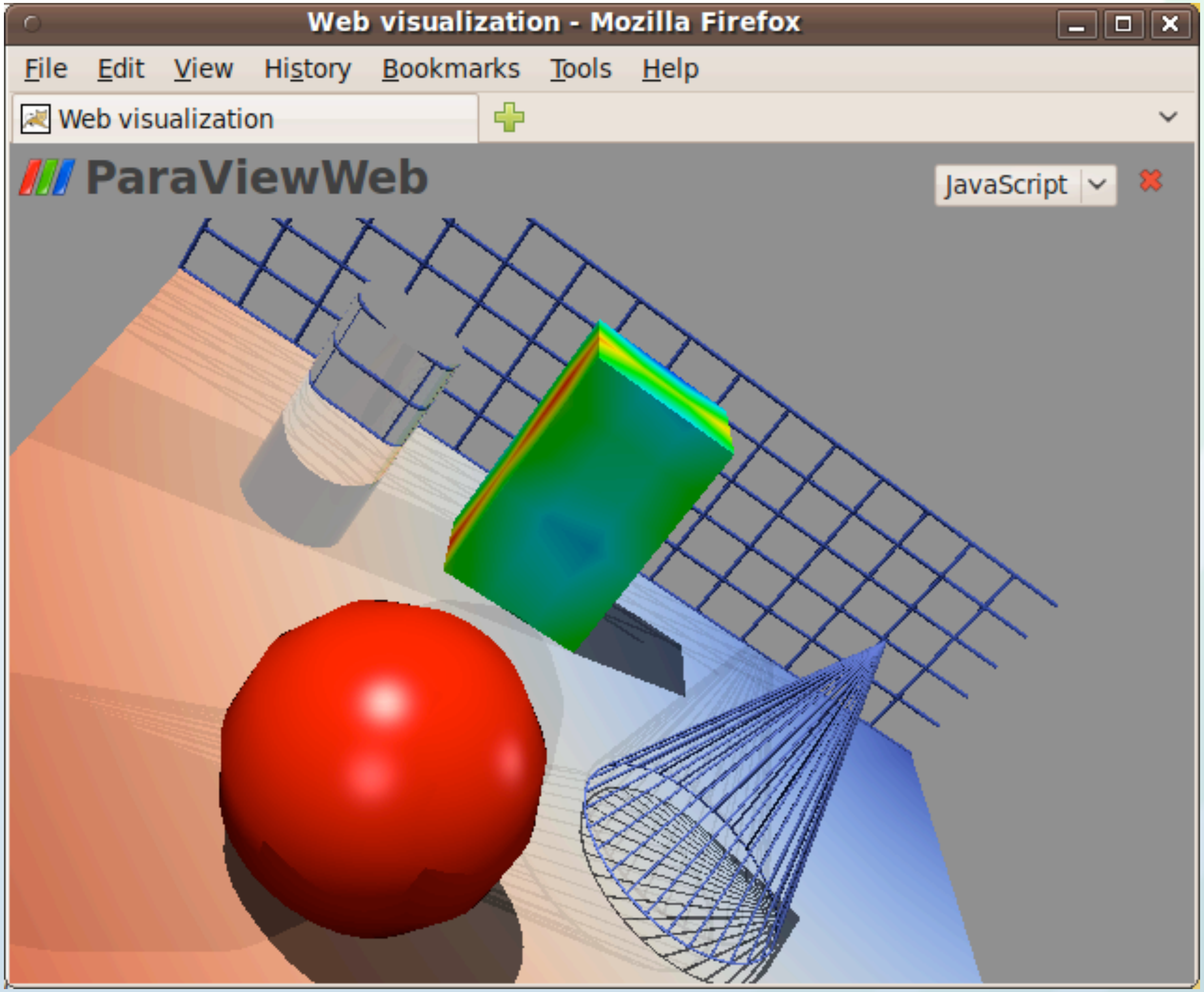
Input data: V

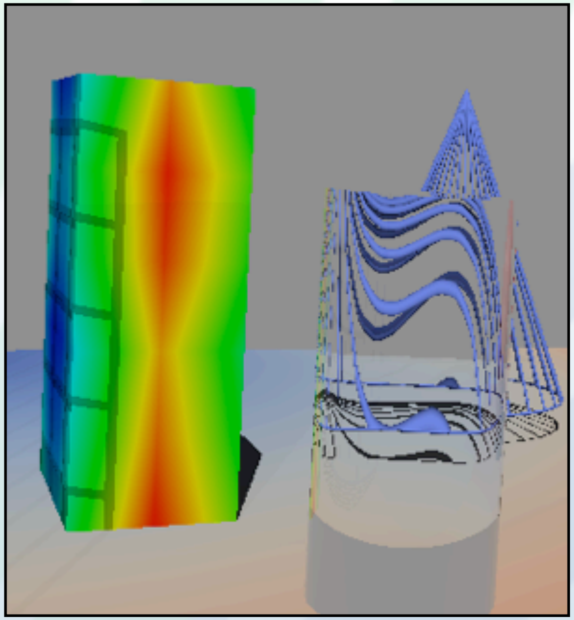
Line resolution: 5

Max stream length: 50

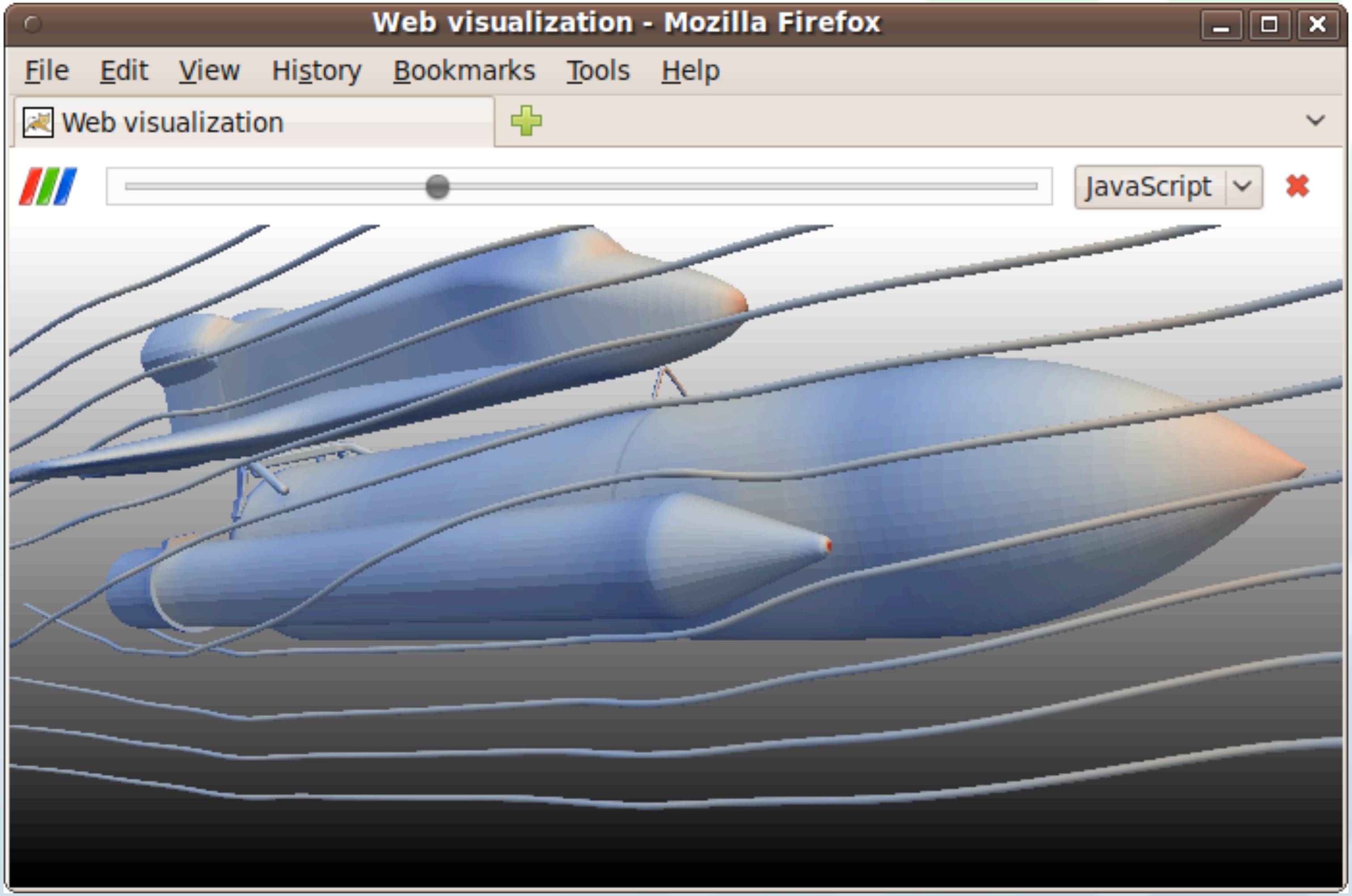
Kitware

Ray casting rendering

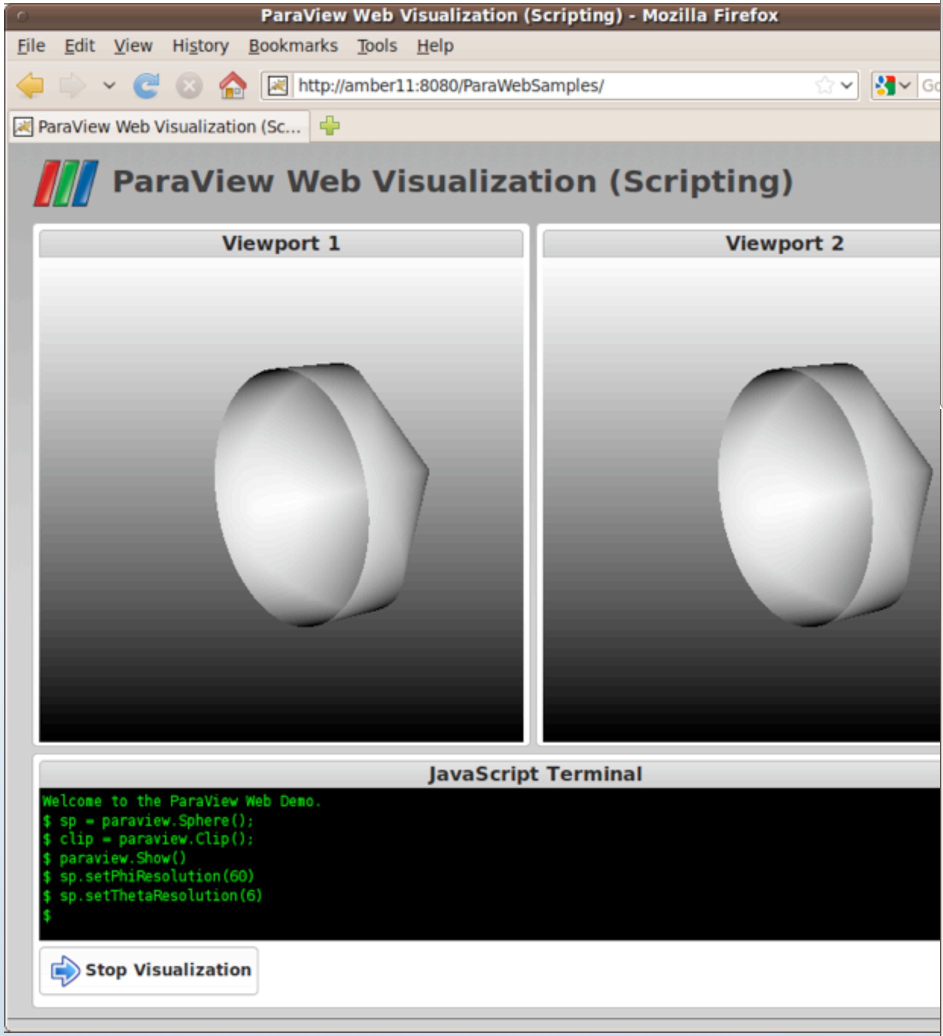




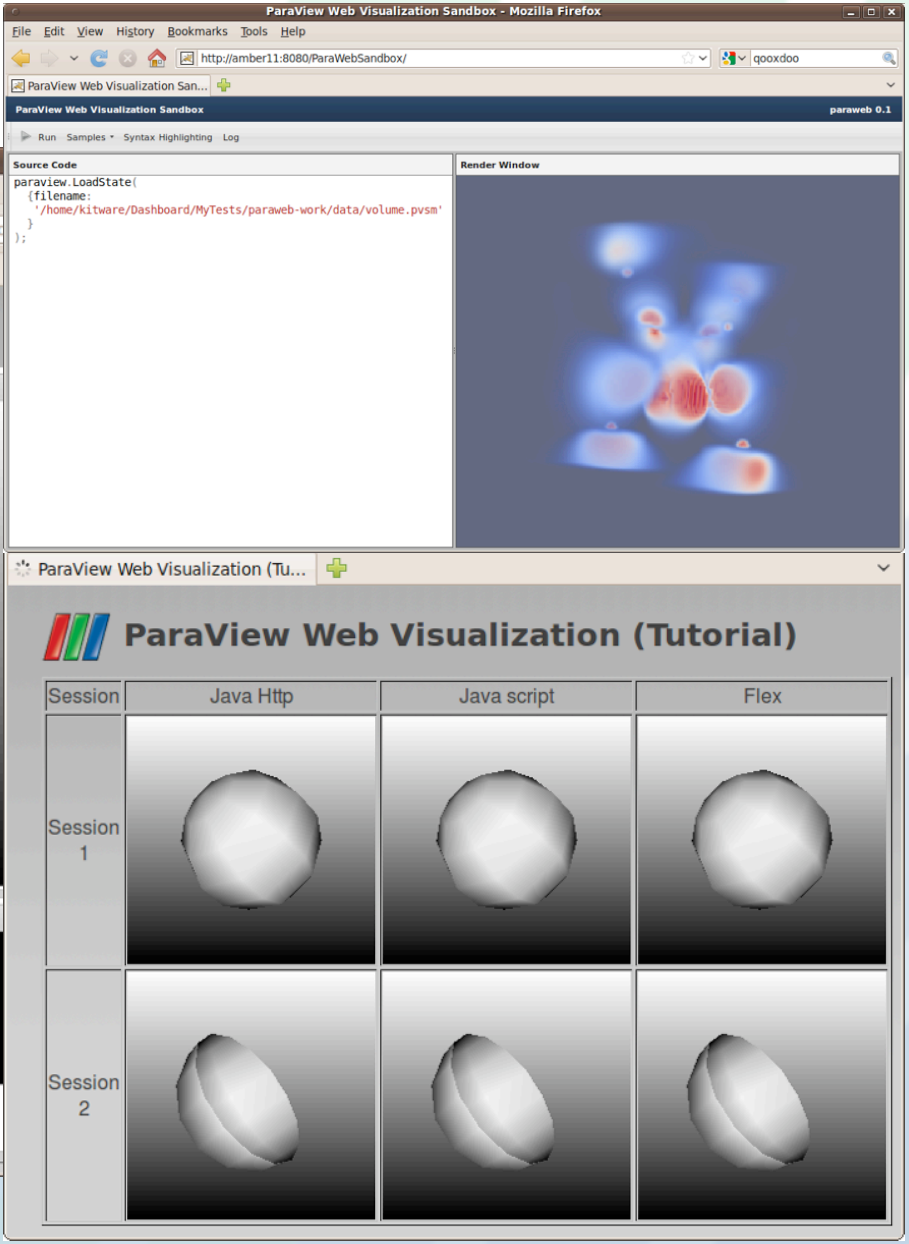
Flow stream for eLearning


Web visualization - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Web visualization
JavaScript

Other samples


ParaView Web Visualization (Scripting) - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://amber11:8080/ParaWebSamples/
ParaView Web Visualization (Sc...
ParaView Web Visualization (Scripting)
Viewport 1
Viewport 2
JavaScript Terminal
Stop Visualization

```
Welcome to the ParaView Web Demo.
$ sp = paraview.Sphere();
$ clip = paraview.Clip();
$ paraview.Show()
$ sp.setPhiResolution(60)
$ sp.setThetaResolution(6)
$
```


ParaView Web Visualization Sandbox - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://amber11:8080/ParaWebSandbox/
qooxdoo
ParaView Web Visualization San...
ParaView Web Visualization Sandbox
paraweb 0.1
Run
Samples
Syntax Highlighting
Log
Source Code
Render Window
ParaView Web Visualization (Tu...
ParaView Web Visualization (Tutorial)
Session
Java Http
Java script
Flex
Session 1
Session 2

```
paraview.LoadState(
  {filename:
   '/home/kitware/Dashboard/MyTests/paraweb-work/data/volume.pvsm'
  }
);
```

First results

- Simple to integrate into existing web sites
- No client side constraints
- Provide good environment for collaboration
- Ease access to data and infrastructure
- Ease to create your own application
- Performance
  - Real time on LAN (90-50 fps)
  - Reasonable from Web across the country (50-20 fps)
  - Reasonable to poor across the atlantic (20-1 fps)

Conclusion

- Flexible and promising framework
  - We will need
    - to add new features: Geometry streaming
    - to follow new standard: Web socket, WebGL...
  - We do have an idea on how to use it today...
  - but the community may find some other ways
- *...*
  - *Without interactivity*
    - *2D plot generator (without interaction)*
    - *Simulation monitoring via dynamic web report*
  - *Without rendering*
    - *Hight performance processing framework without rendering*

Kitware

Questions ?

Demo can be done after the session...

http://paraviewweb.kitware.com

sebastien.jourdain@kitware.com