



# VTK Vanguard

What's new in the trusty old Visualization Toolkit

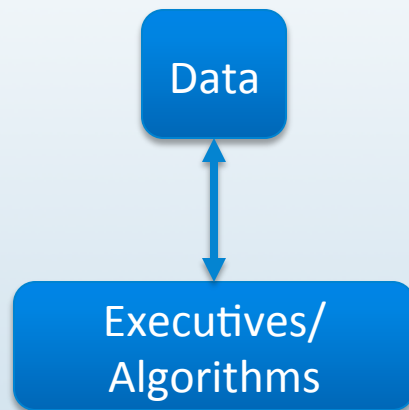
	releases	Emails	committers	KW downloads
1999	2.4.0	1429	20	
2000	3.1.0-.2	2807	22	
2001	3.2.0	3588	24	
2002		5222	26	
2003	4.0.2, 4.2.0-.5	5164	32	
2004	4.2.6, 4.4.0-2	5670	27	
2005	5.0.0	4776	38	
2006	5.0.1-.2	4689	36	
2007	5.0.3	4052	40	
2008	5.0.4, 5.2.0-.1	4797	51	
2009	5.4.0-.2	7067	60	
2010	5.6.0-.1	10825	91	3969
2011	5.8.0	7982	71	4712
2012	5.10.0-.1	7683	57	7243
2013	6.0.0	6730	68	10707
2014 ao Apr	6.1.0, ?6.2.0?	1564	36	1065

# 6.0.0 Jun 2013

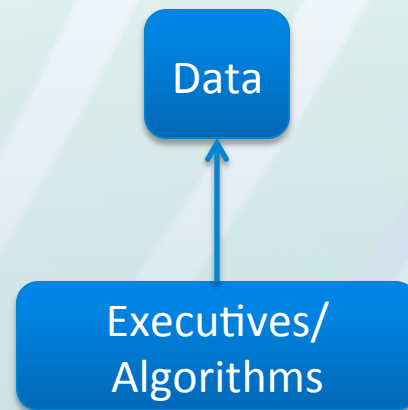
- Pipeline updates
- Modularization
- Mean Value Coordinates mesh interpolation
- vtkPiston
- etc:Categorical Colors, Vector Graphics outputs

# Pipeline Updates

- Removed VTK 4 backward compatibility  
`vtkDataObject::GetProducerPort()`?  
`vtkAlgorithm::SetInput()` vs `SetInputConnection()`



VTK 5



VTK 6

# Modularization

Data

VTK Minimal

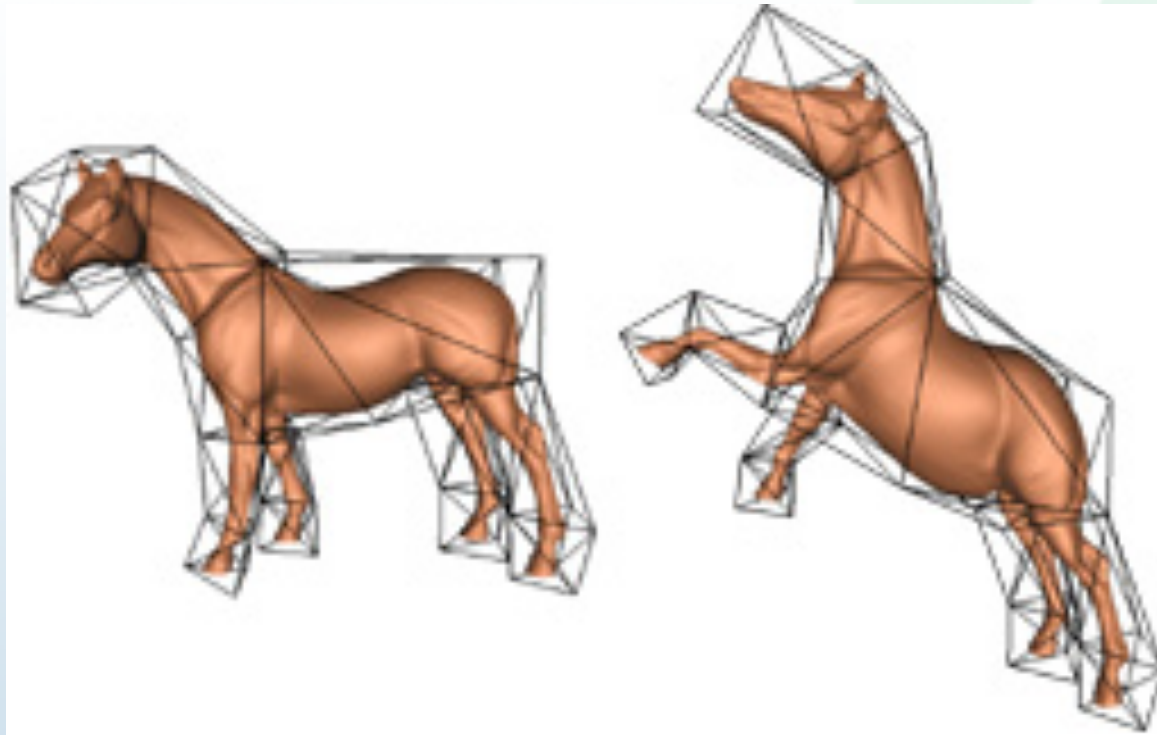
# Modularization

- Reorganize and modernize cmake script
- 19 kits -> 107 modules
- Can remove just by deleting directories (100MB->5MB)
- Easier to add external Modules
- Code behavior is constant
  - ex, `VTK_USE_PARALLEL` doesn't make any class compile or behave differently, it merely enables additional classes

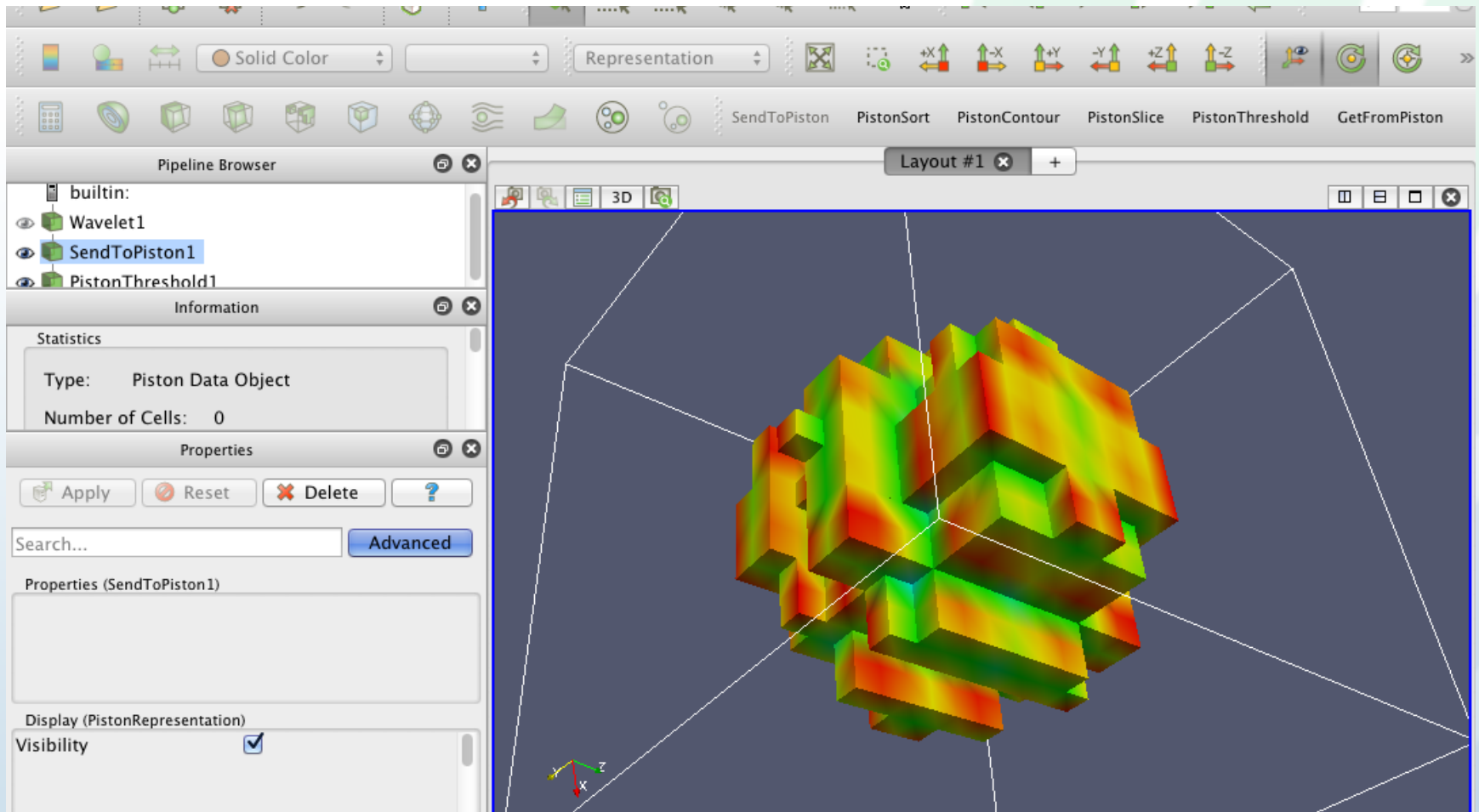


# DeformPointSet

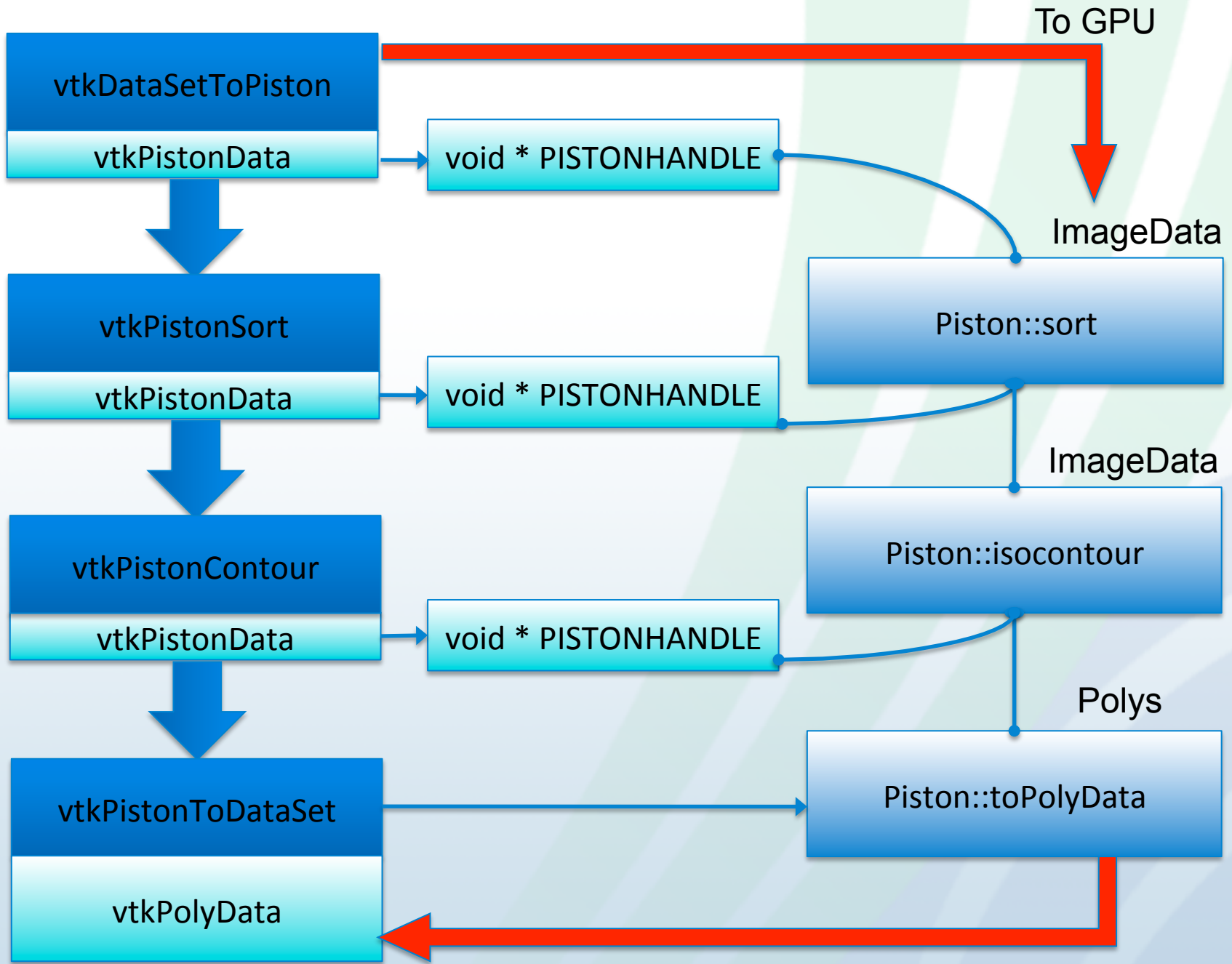
- Mean Value Coordinates mesh warping

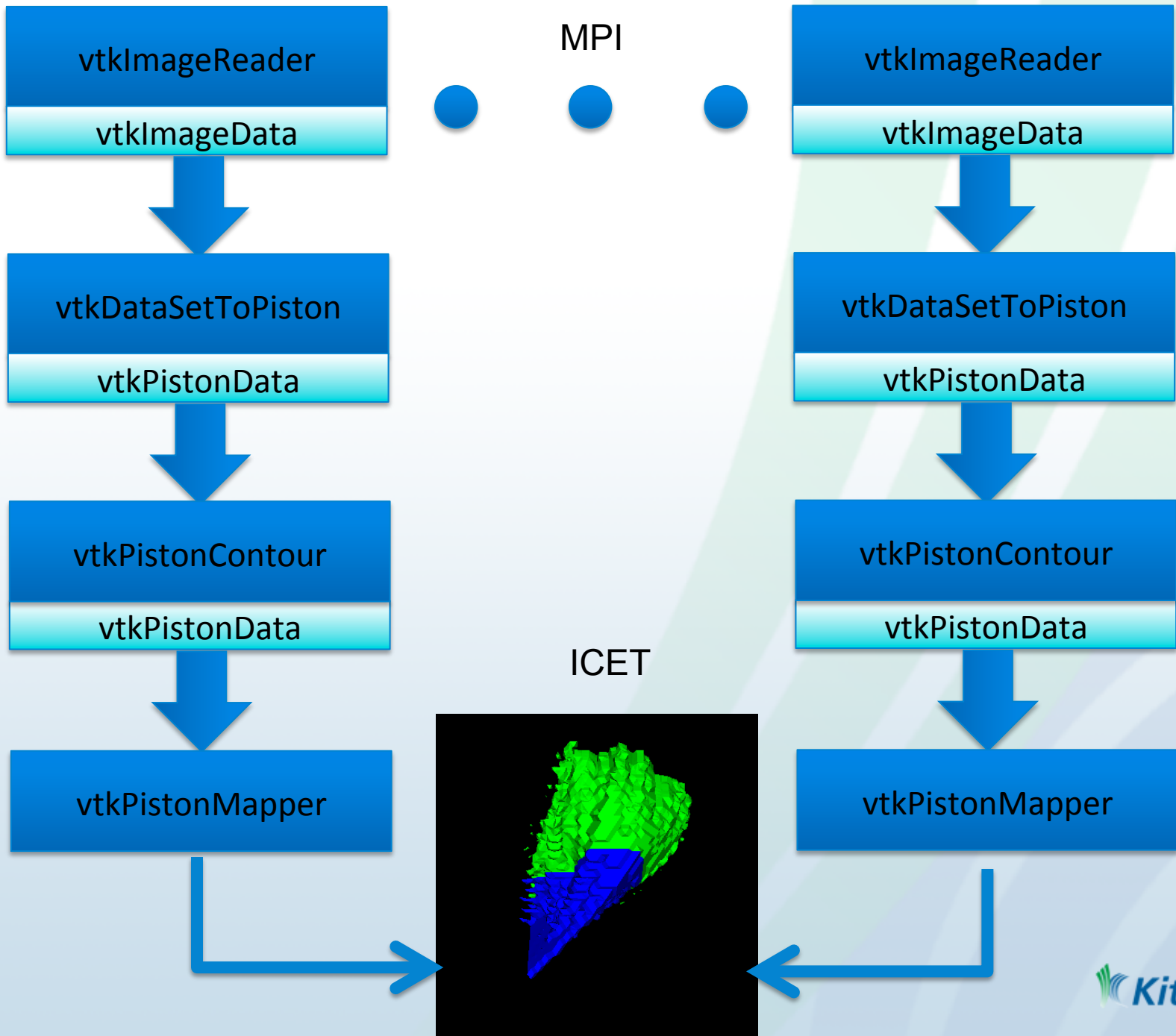


# vtkPiston & ParaView Piston Plugin









MPI

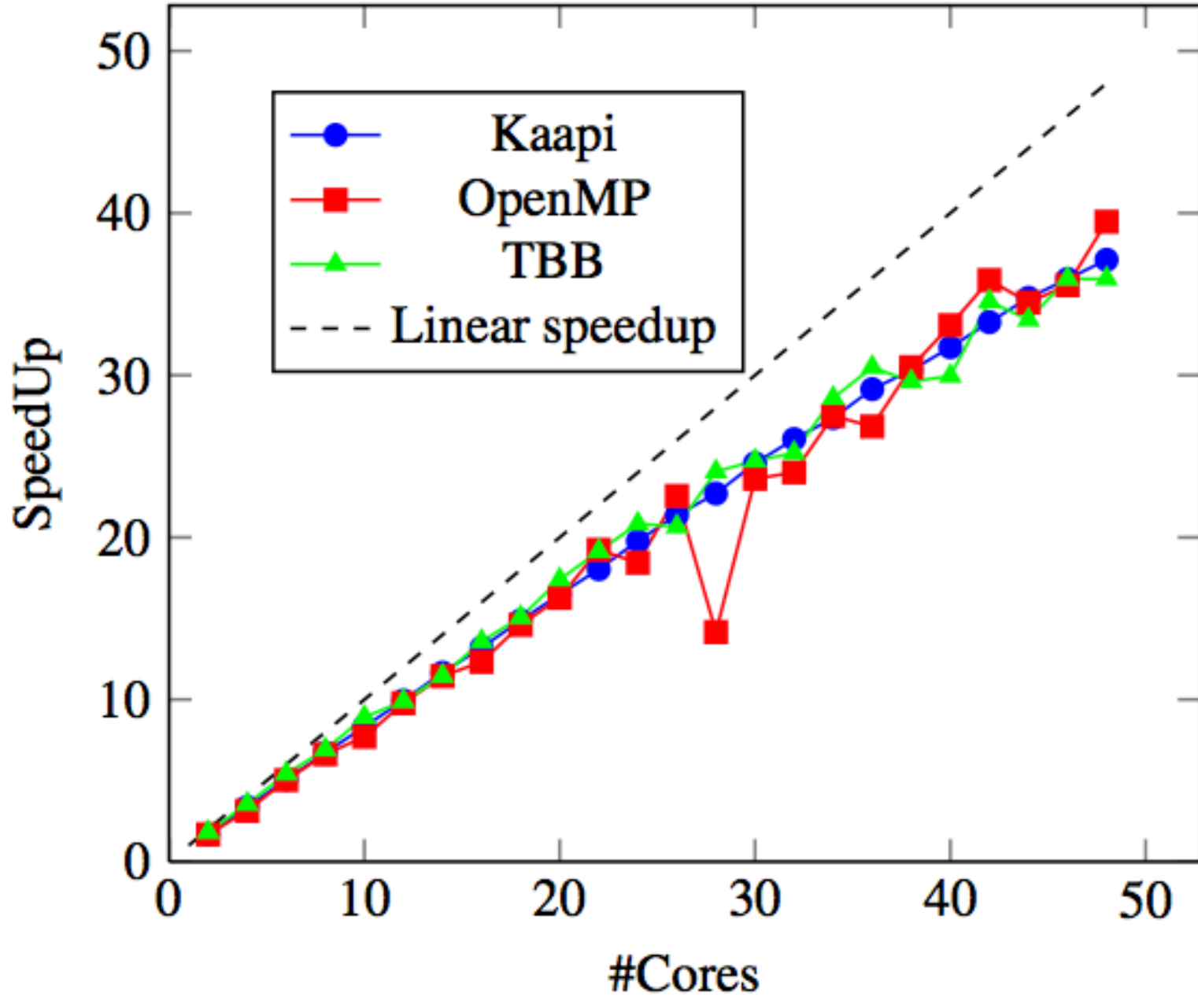
ICET

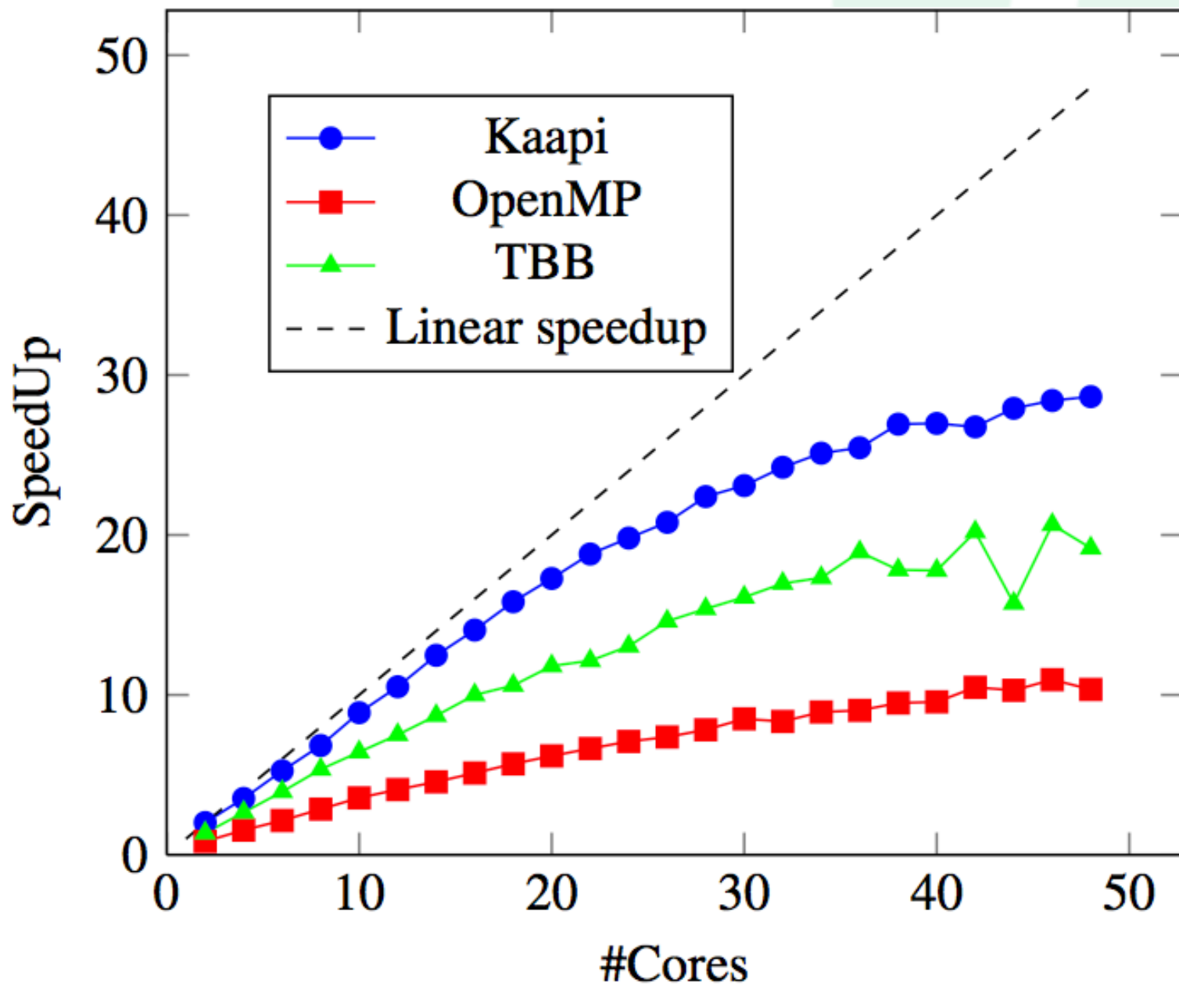
## 6.1.0 Jan 2014

- vtkDax, vtkSMP
- vtkWeb
- InSitu Data Structures (zero copy arrays)
- vtkPython binaries
  
- etc: ext netcdf, qt5, python binaries, JOGL, testing infrastructure

# vtkSMP - threaded unstructured filters

- [http://www.vtk.org/Wiki/VTK/VTK\\_SMP](http://www.vtk.org/Wiki/VTK/VTK_SMP)
- A lightweight threading abstraction
  - various back ends including Intel's TBB and Inria's Kaapi
- Minimal building blocks above abstraction layer
  1. parallel for
  2. thread local storage
  3. atomic operations, especially fast atomic ints
  4. efficient parallel point merge operator
- See: Common/Core/\*SMP\*,
  - Filters/SMP/[Transform|Contour]
- **WARNING:** Does not mean that all of VTK is thread safe!





# vtkWeb - visualization over the web

- Core ParaviewWeb Version 3\* promoted to VTK
- Dependencies:
  - before: activemq-cpp, apr, apr-util, tomcat
  - now: zope.py, autobahn.py, twisted.py all in VTK3rdParty
- 1. `VTK_WRAP_PYTHON, VTK_Group_Web=ON`
- 2. Compile
- 3. `vtkpython Wrapping/Python/vtk/web/vtk_web_cone.py \`  
`--content www -p 11111`
- 4. `http://localhost:11111/apps/Cone`

6.1 \* has not burned, fallen over and sunk into the swamp yet

# Where does it work?

- Any modern browser that supports WebSocket
- Safari on iOS (iPhone, iPad, iPod)
- Chrome on some Android devices



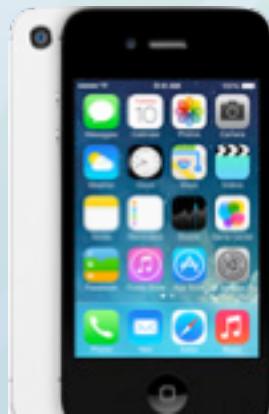
Firefox  
11+



Chrome 14+



Safari 6+



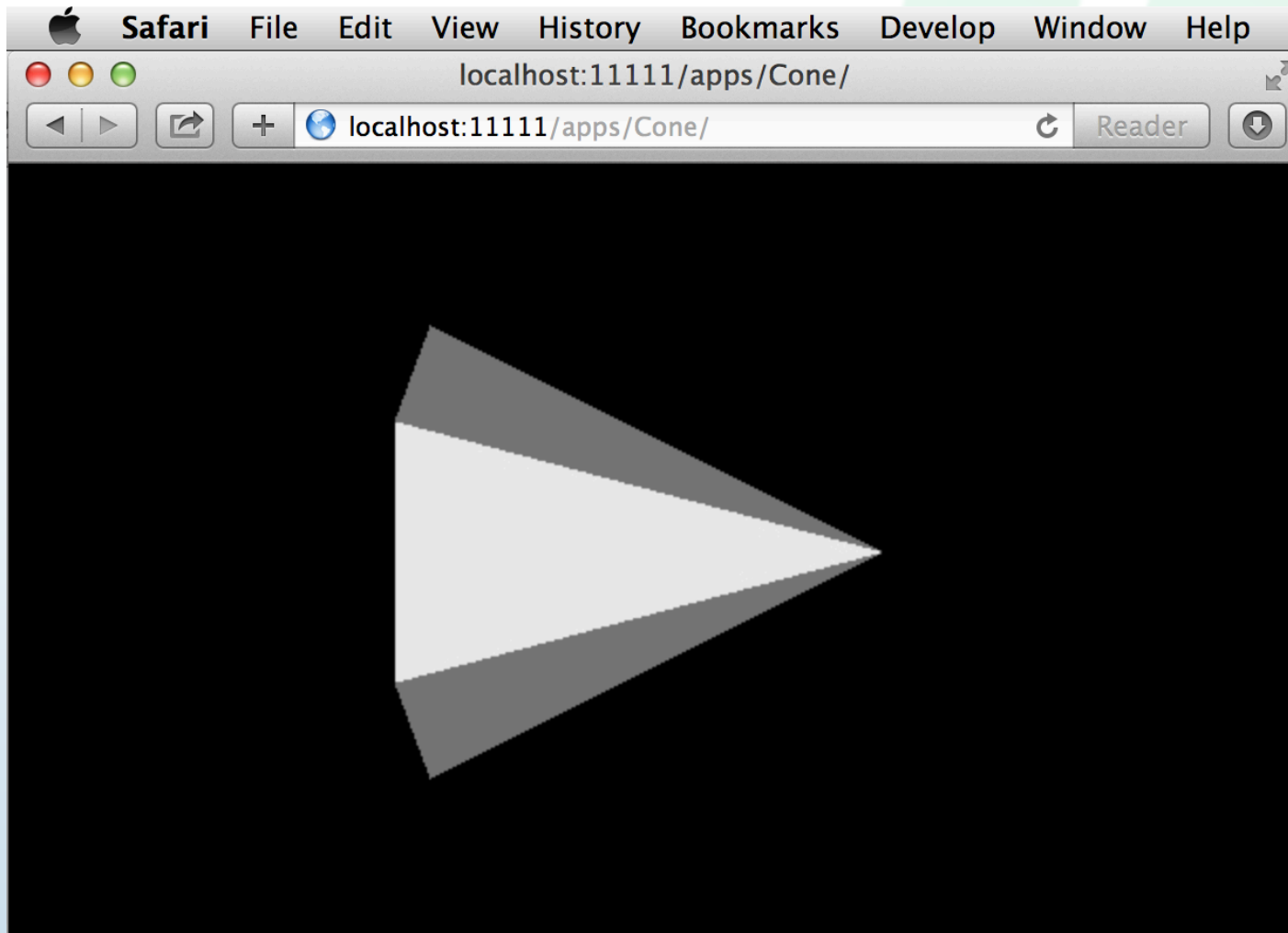
Opera  
12.1



Internet Explorer 10



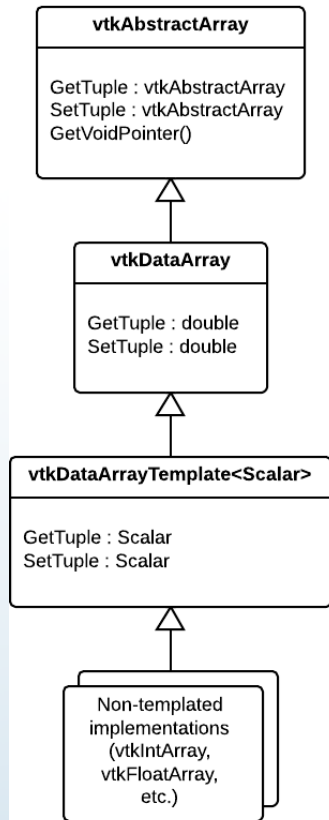
# vtkWeb demo



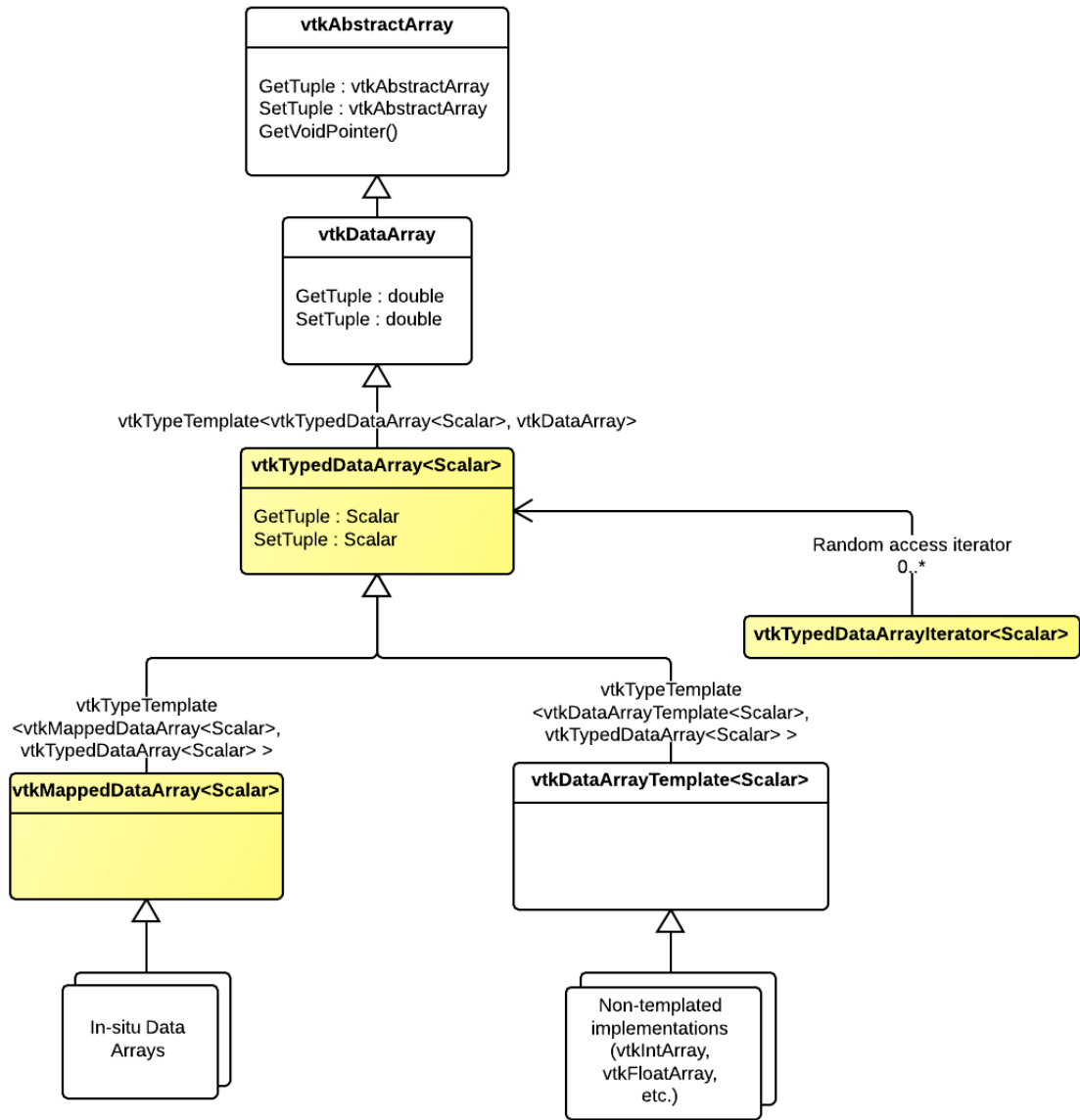
# In Situ (zero copy) data structures

- Problem - conform to VTK array layout or die!  
ex.  $x^1y^1z^1x^2y^2z^2x^3y^3z^3\dots$  vs  $x^1x^2x^3\dots y^1y^2y^3\dots z^1z^2z^3\dots$
- API gives direct access to implementation
  - `vtkDataArray::GetVoidPointer()`
  - `vtkUnstructuredGrid::GetCells()` etc..
- Solution: template meta programming to the rescue (with STL like iterator access)
- <http://www.vtk.org/Wiki/VTK/InSituDataStructures>

#\$!\*&@



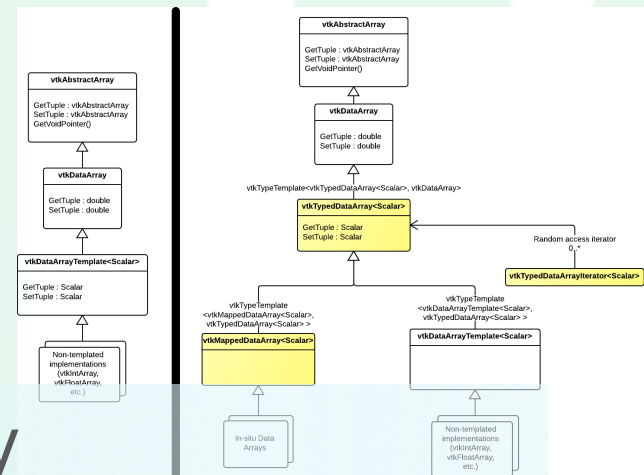
Old



New

# Mapped Arrays

- Derive from `vtkMappedDataArray`
  - Fill in virtual data access methods for your data layout
  - Will spit out warnings wherever `RawPointerAccess` happens, and default to returning pointer to a manually extracted copy
- incompatible filters take slow path
- they will be updated as needed
- iterator access pattern makes updating straightforward

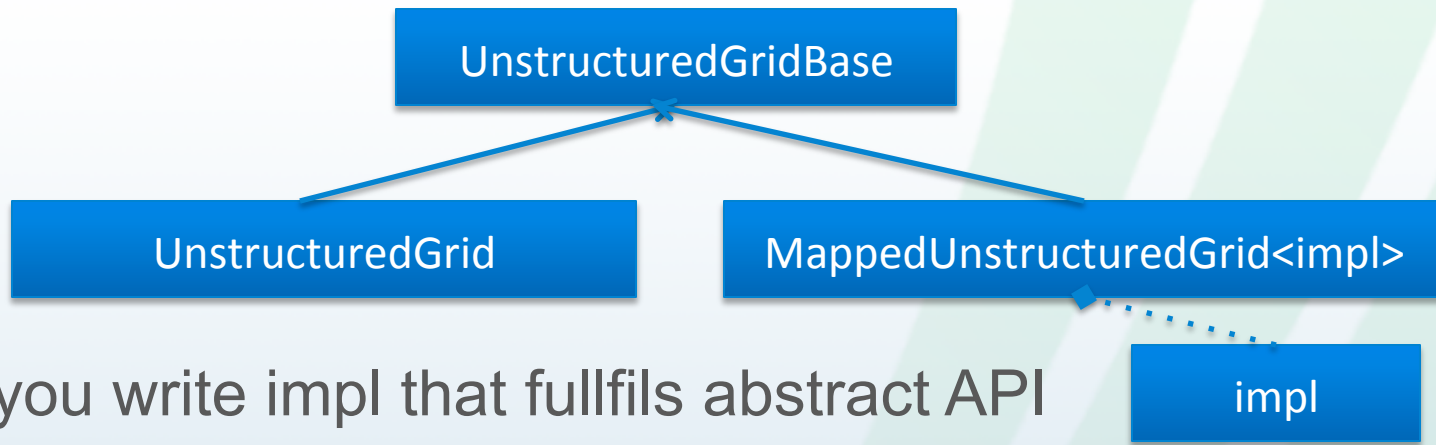


Old

New

# Mapped Unstructured Grids

- CellConnectivity



- you write impl that fullfils abstract API
- iterators (ex vtkCellIterator) make it fairly easy to update
- See TestInsituExodus to get started
- <https://github.com/gahansen/Albany/tree/master/src/disc/catalyst>

## 6.2.0 ~Sept 2014 to include some of...

- Ghost cell generation
  - George Zagaris for European customers
- XDMF3
  - Dave DeMarle with Ken Leiter at ARL
- Adios++
  - Chuck Atkins with ?
- Sane structured/unstructured dichotomy
  - Berk Geveci for InSitu SBIR
- Binary SDK, Java Maven and Python PIP
  - DeMarle/Jourdain for NIH and others

# 6.3.0 ~Feb 2015 to include some of...

- vtk2vtkm?
- NIH VTK Maintenance Grant
  - update rendering/interaction
    - Chaudary/Avila/Hanwell/Martin et al
    - SceneGraph
    - OpenGL >=2.3, VBOs, improved context creation/sharing
    - Reduced memory footprint
    - Preliminary tests: 14 million pt Lucy.ply
      - 4.02s/f -> .16s/f, CPU 100%->5%, RAM -3GB
  - Infrastructure to encourage community code

