

A photograph of the TU Delft amphitheater, featuring a large concrete structure with a lattice tower on top, set against a clear blue sky. The foreground shows a wide set of concrete steps leading up to a grassy area where many people are sitting and socializing. The text is overlaid on a black rectangular background in the center of the image.

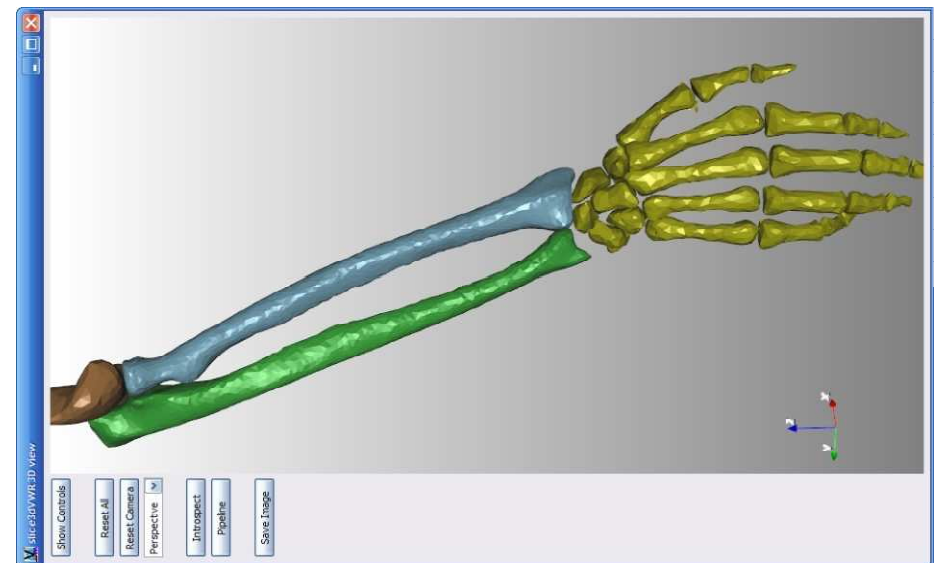
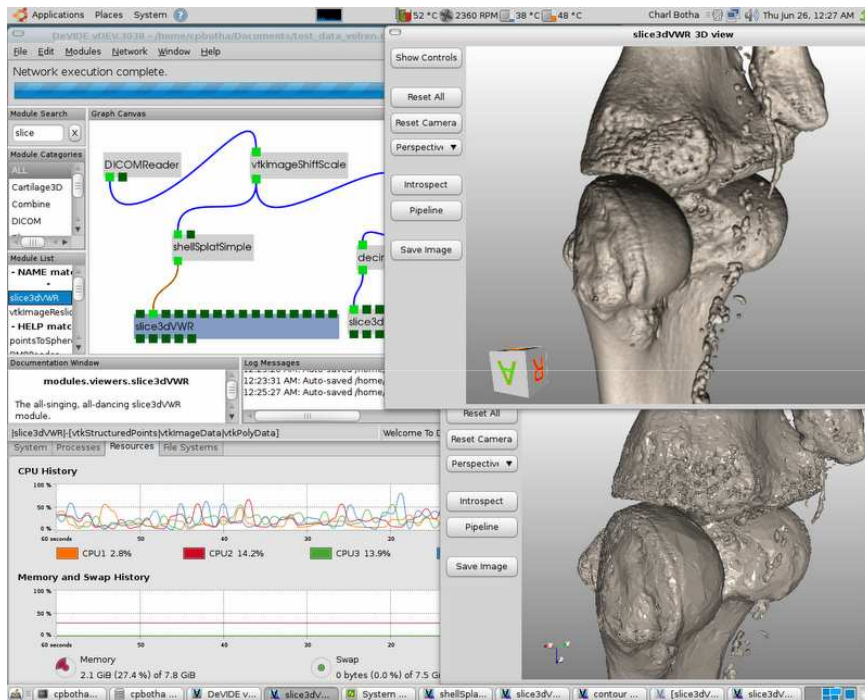
# The DeVIDE Runtime Environment

## An Instantly-deployable Python-VTK-ITK lab

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15-10-2009

# DeVIDE

- *Delft Visualisation and Image processing Development Environment*, since 2002
- **Cross-platform turn-key rapid prototyping** environment for medical visualisation and image processing techniques
- Supports **visual programming**



# Demo?

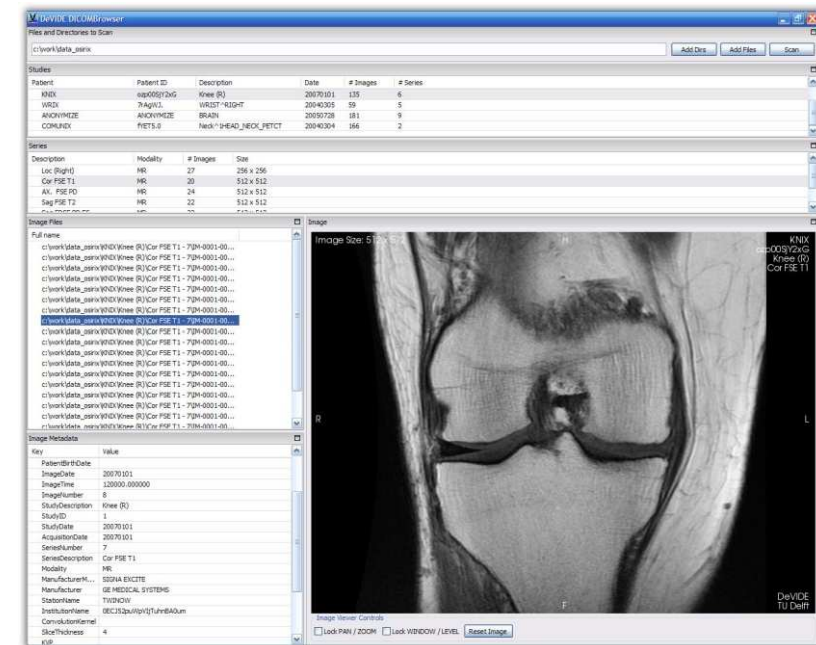
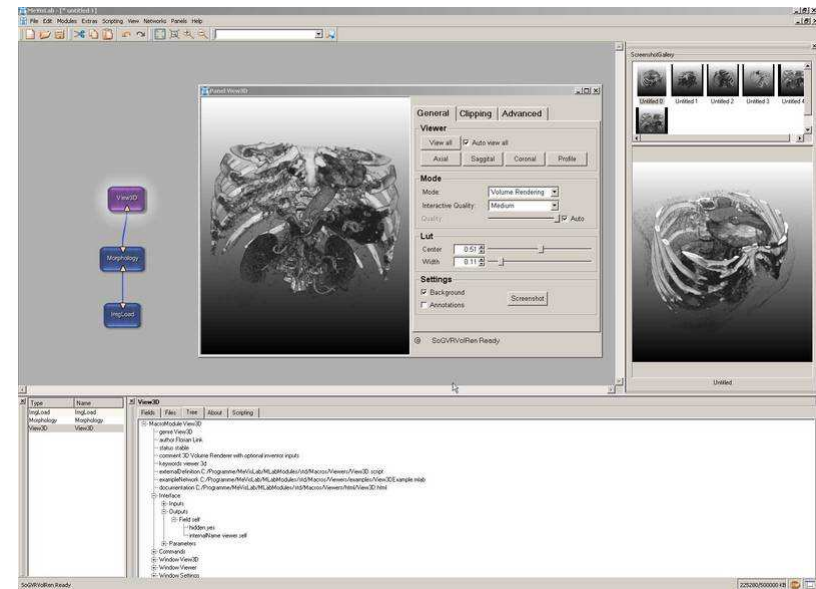
- Loading the superquadric.
- Introspection, CodeRunner with SphereSource.
- DICOMBrowser, DICOMReader, Slicer.

# DeVIDE

- **Pervasive interaction** down to code-level at run-time!
- VTK, ITK, numpy, matplotlib, statistics, the kitchen sink, all out of the box.
- **Now also self-contained DeVIDE Runtime Environment!**
- **Off-line mode** for large-scale processing, can be used as black-box by coordination framework, e.g. Nimrod
  - Parameter sweeps
  - Large scale processing (many datasets)
  - Use in production workflow
- **Same software is used for all stages:** algorithm prototyping, large-scale processing, and post-process visual analysis.
- Lovingly dubbed "*Not Responding*" by students (32 vs 64)

# Similar solutions

- AVS, OpenDX
- Amira
- SCIRun
- MeVisLab
- VisTrails
- Why DeVIDE?
  - Made for medical vis + ip
  - Introspection
  - Ease of integration
  - Prototyping
  - Python.
  - Hybrid Scheduling
  - BSD open source.
  - Runtime environment.
  - Close to libraries.

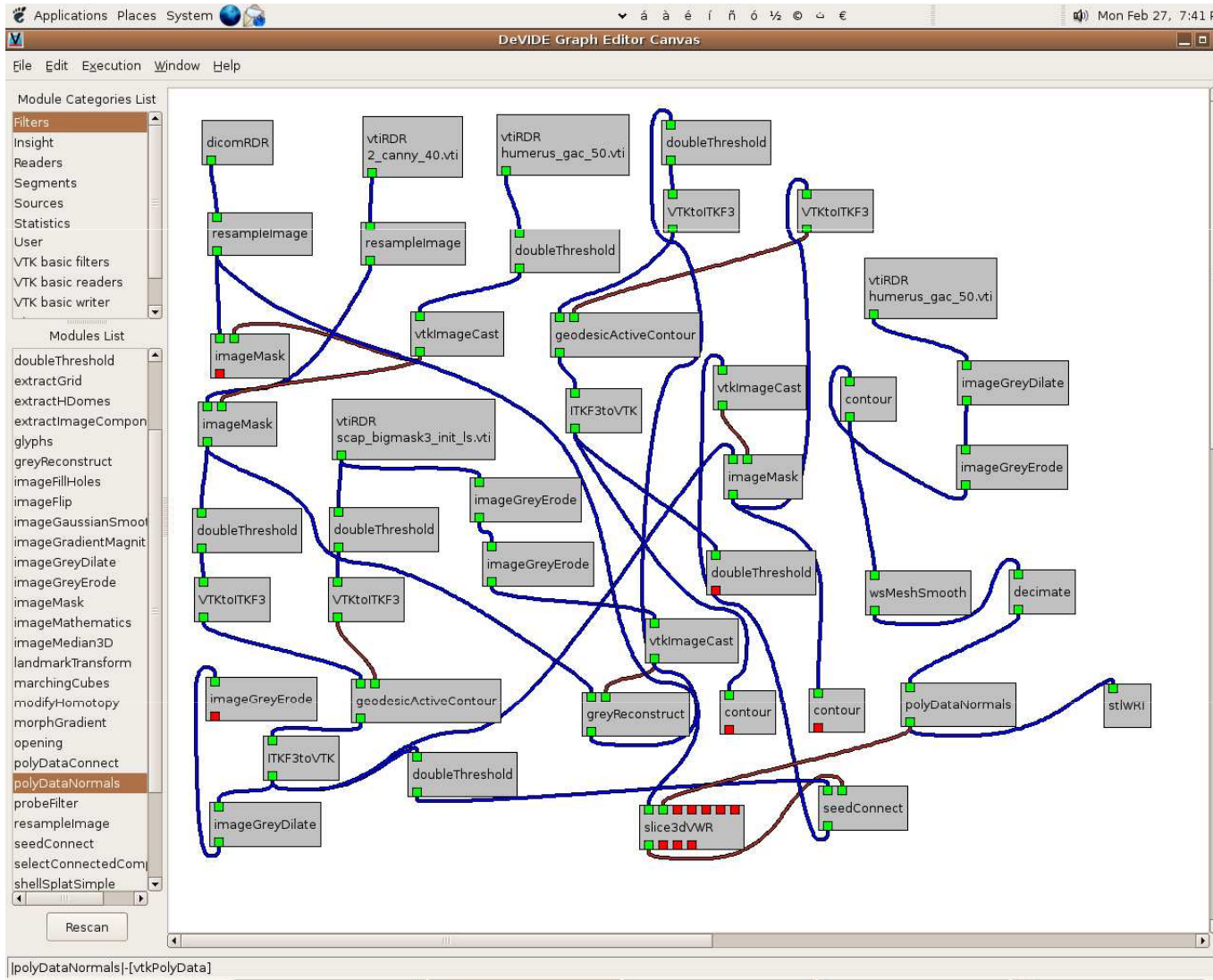


# What happened since Vis2007

- Open source announcement at the BOF in 2007.
- Hybrid scheduling + OSS paper [1]
- Releases:
  - 8.2: Hybrid Scheduling, first OSS release.
  - 8.5: DICOMBrowser
  - 9.1: Student proof! M.Sc. MedVis.
  - 9.8: DeVIDE Runtime Environment (DRE)

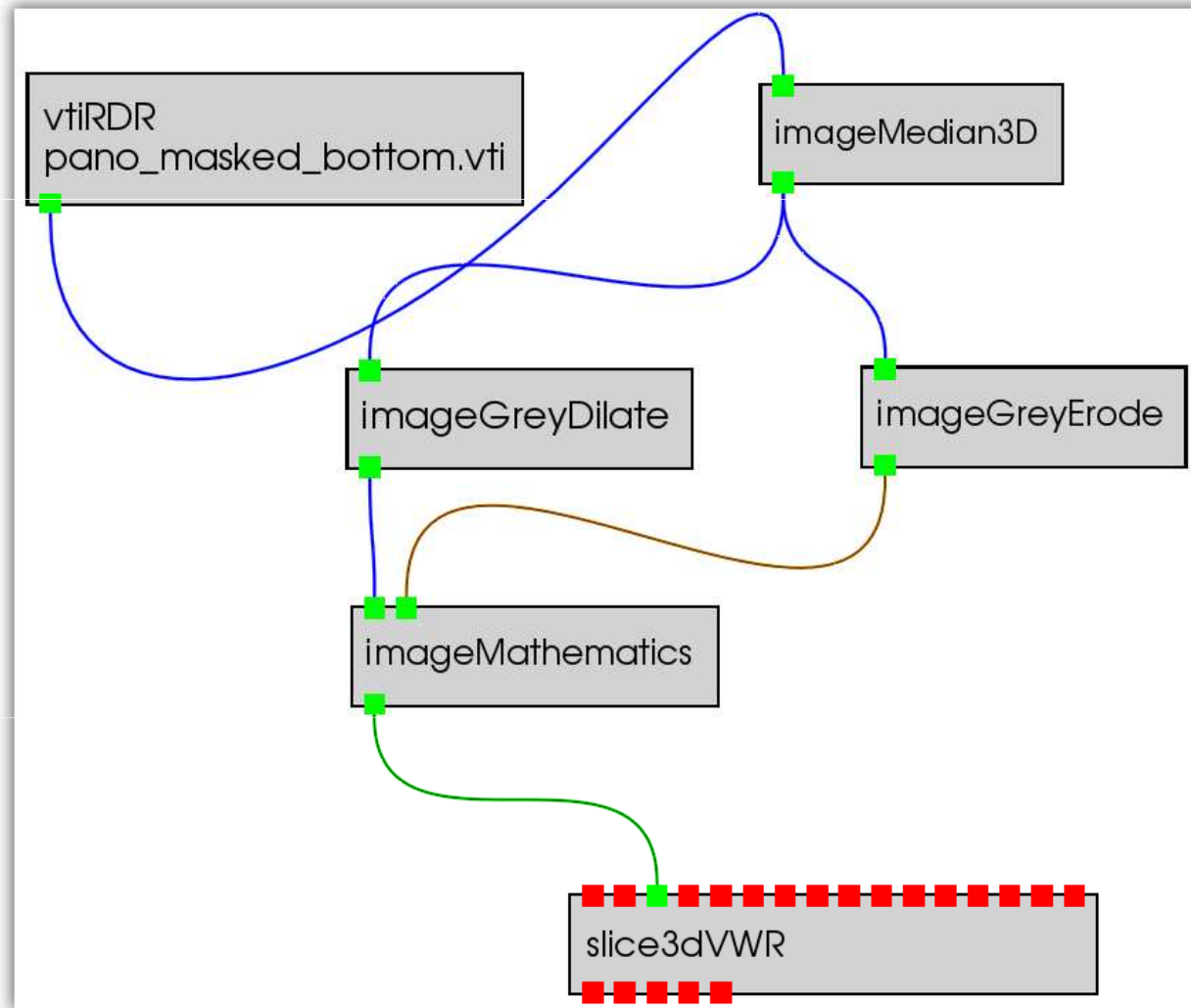
[1] C.P. Botha and F.H. Post, "Hybrid Scheduling in the DeVIDE Dataflow Visualisation Environment," *Proceedings of Simulation and Visualization*, H. Hauser, S. Strassburger, and H. Theisel, SCS Publishing House Erlangen, 2008, pp. 309-322. Best Paper.

# Scheduling



- 2 major approaches: demand vs event
- Memory vs. simplicity
- e.g.: MeVisLab, Amira, SCIRun, VTK/ITK, VisTrails

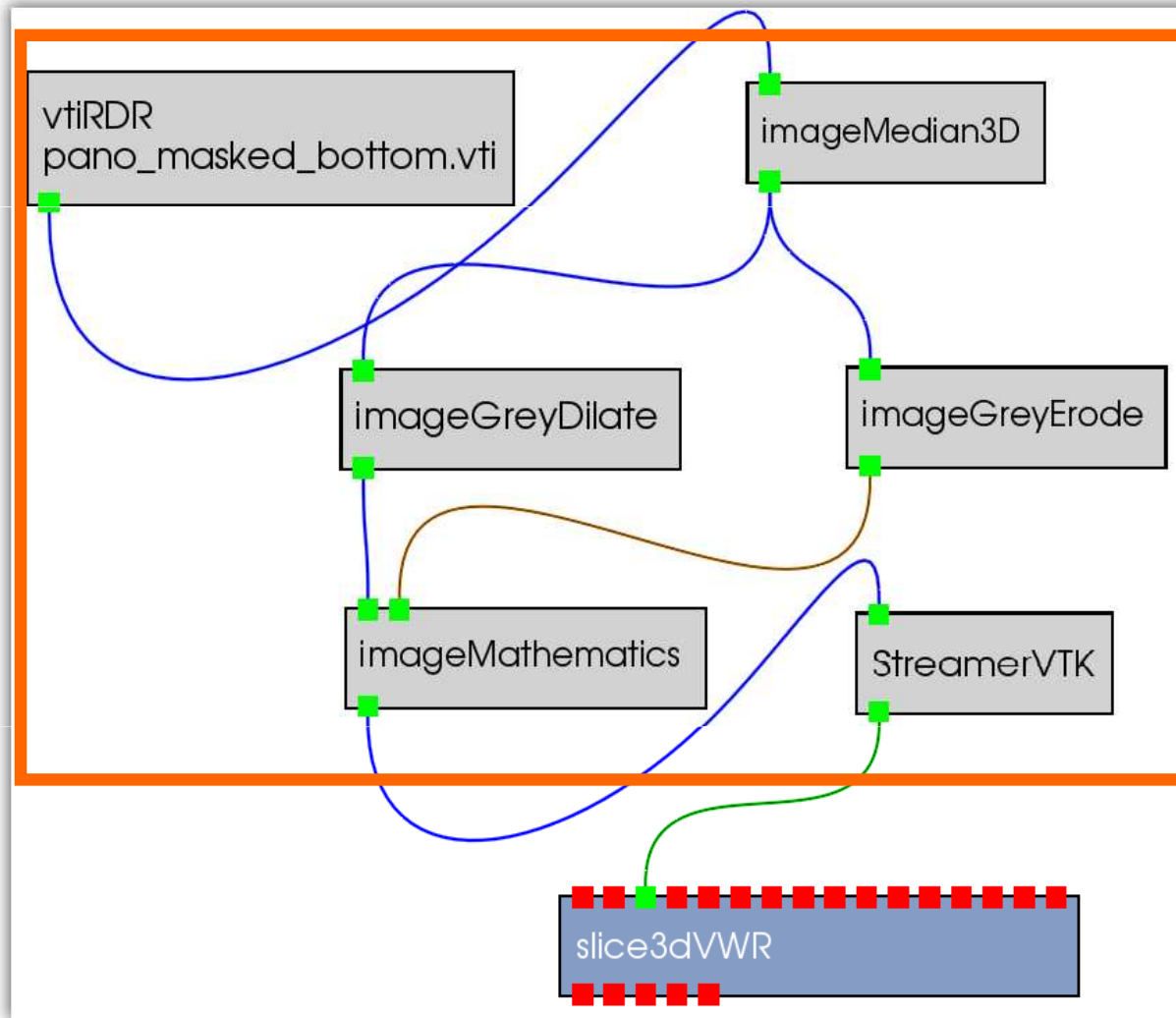
# Event-driven Scheduling



- Central
- Simple
- K x data
- e.g. 5 \* 500 MB  
= 1.5G

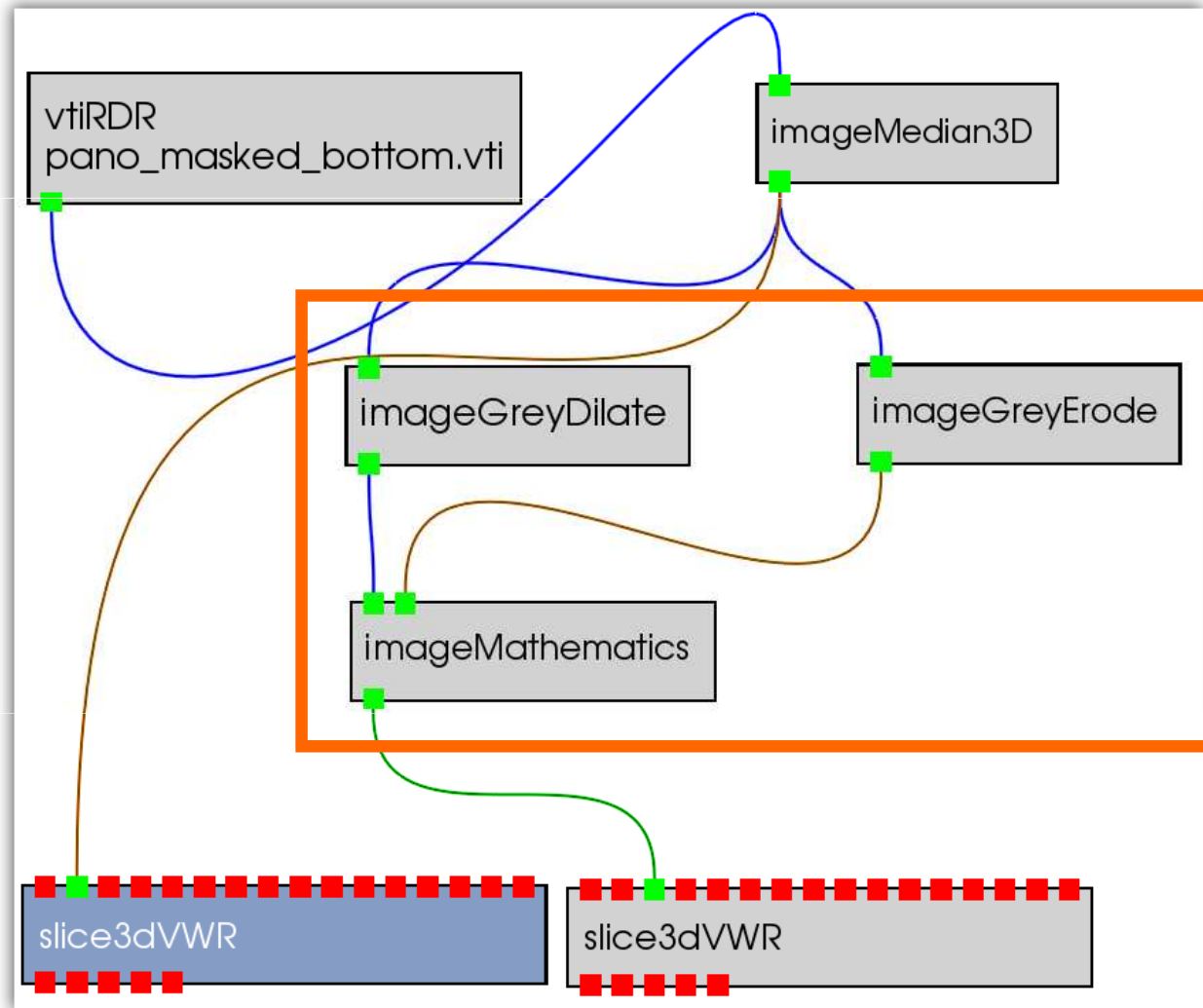


# Hybrid Scheduling



- Streamable subsets
- $(1 + K * 1/N)$  data
- e.g.  $500 + 5 * 25 = 650$  MB
- Interactive (1)

# Hybrid Scheduling



- Adaptive
- Re-analyses topology at each execution
- Simplicity + efficiency!

# The DRE

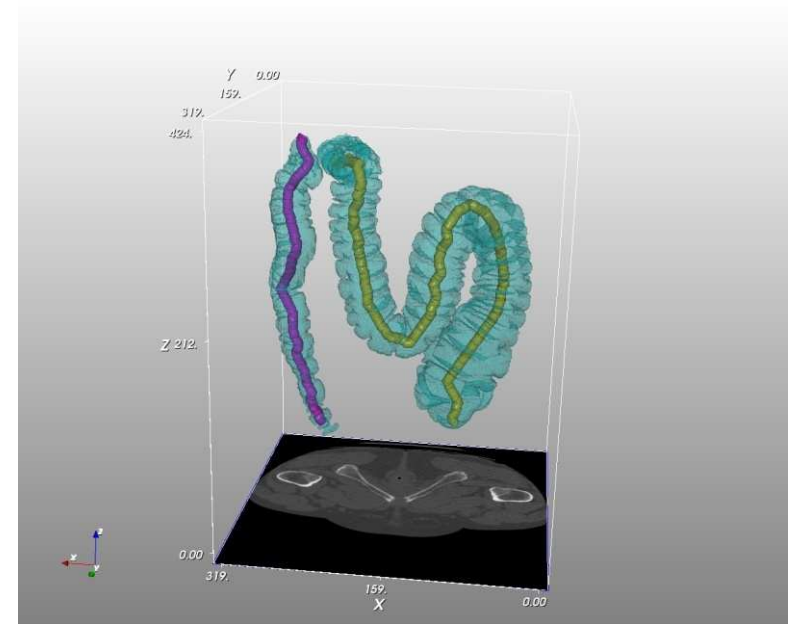
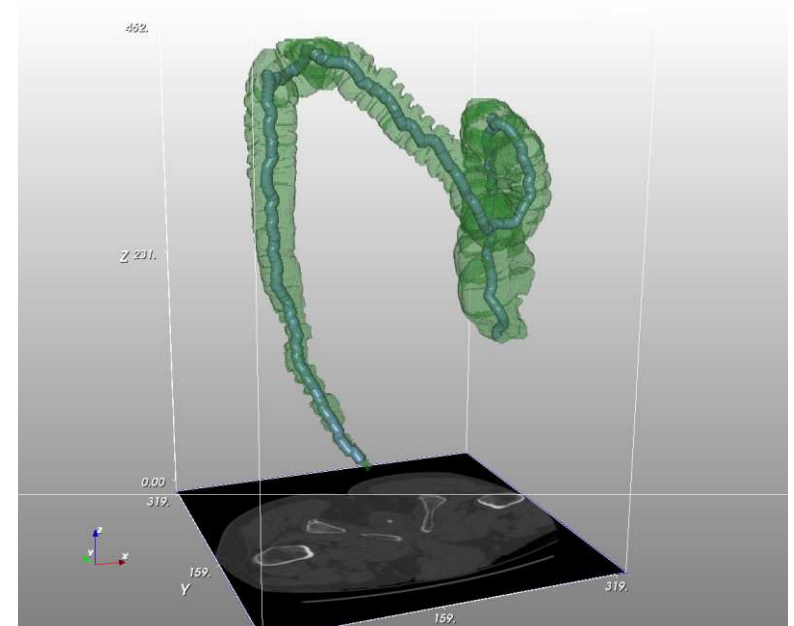


*The most efficient way of 'wrapping' a big library is eating it.*

- DeVIDE is now a Python distribution including the following:
  - Python 2.6.2 final-0, numpy 1.3.0, matplotlib 0.98.5.3, wxPython 2.8.10.1, VTK 5.4.2 with special sauce, ITK 3.14.0, gdcm 2.0.12, dcmtk
  - Swig 1.3.38, WrapITK 0.3.0 !!
- Single downloadable installer: Linux 32/64, Win 32/64
- DRE Application Modules == DREAMs
  - DeVIDE
  - ipython, python-wx shell
  - Any other Python script relying on any combination of above libs
  - This means: "dre your\_python\_script.py" just works.
- Full SDK included, just add compiler.\*

# Future work, Info

- Integrating more out-of-the-box libraries, 700MB installed is not enough 😊
- Slice-by-slice segmentation tool.
- Incremental update tool.
- More momentum.
  
- Website:  
<http://visualization.tudelft.nl/Projects/DeVIDE>
- Help:  
<http://code.google.com/p/devide/wiki/HelpDRE>
- Master-level workshop-format MedVis course:  
<http://visualisation.tudelft.nl/Courses/in4307>

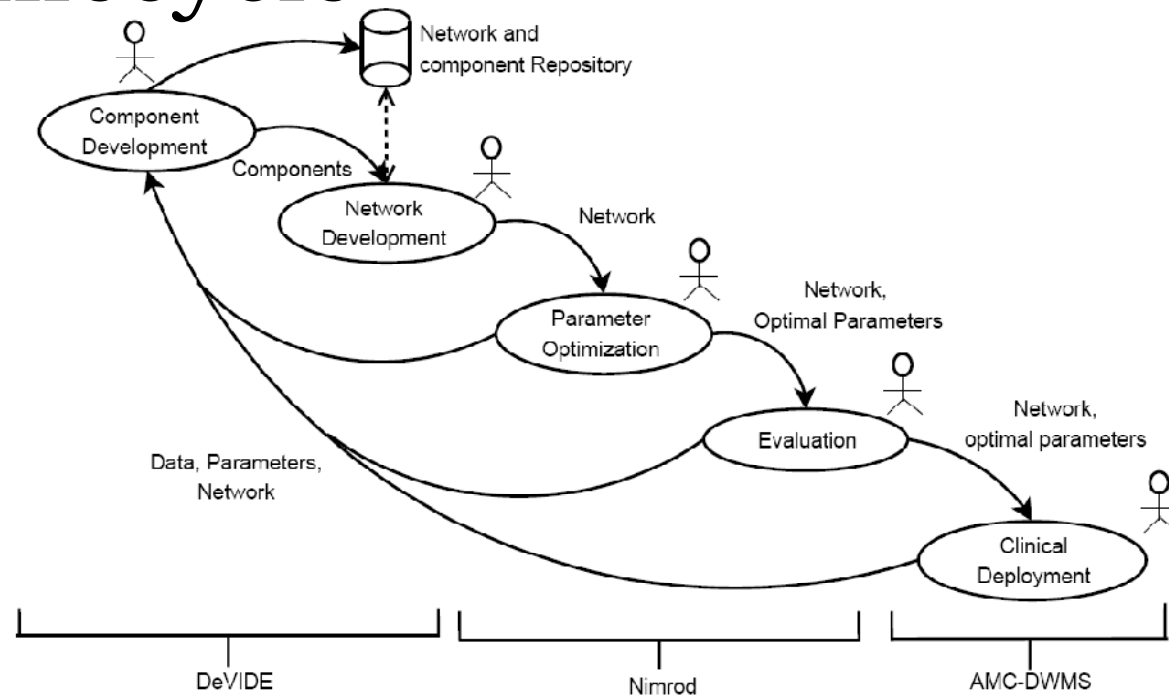


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# Detour: TUD MedVis Overview

- Faculty EEMCS, Dept. Mediamatics, Computer Graphics, Visualisation, Medical Visualisation
- 1 associate prof., 1 assistant prof., 6 PhD students, 5 M.Sc. students.
- Medical Visualisation application areas focused on:
  - medical research (neuro, longitudinal, molecular)
  - diagnosis and treatment planning
- Cooperating with academic hospitals in NL (especially LUMC), Philips Medical Systems, Medis, TU/e
- Medical Delta: TUD, LUMC, EMC

# MIA lifecycle



**Figure 1. Information flow among phases of the MIA lifecycle, from development to clinical deployment, and the systems involved: DeVIDE, Nimrod, AMC-DWMS**

- Olabarriaga, Snel, Botha, Belleman, "Integrated Support for Medical Image Analysis Methods: from Development to Clinical Application," *IEEE Trans. on Inform. Tech. in Biomed.*, **2007**, *11*, 47-57
- Maheshwari, Olabarriaga, Botha, Snel, Alkemade, Belloum, "Problem Solving Environment for Medical Image Analysis" in *Proc. IEEE Intern. Symp. Computer Based Medical Systems (CBMS)*, **2007**

# Some Use Cases

- In progress: recumbent, recumbent lat, sitting MRI for cord-sac spine analysis; CT processing for instrumented prosthesis analysis
- Medical image analysis problem solving on the grid (Maheshwari2007)
- MIA development workflow (Olabarriaga2007)
- Retrobulbar fat analysis (ARVO 2005, ASCI 2005)
- Parts of Visible Orbit reconstruction (ARVO 2005b)
- Pelvic floor deformation (Am.J.Obst.Gyn. 2004)
- Pre-op planning (SimVis2006)
- Chorionic villi visualisation
- Shoulder segmentation

