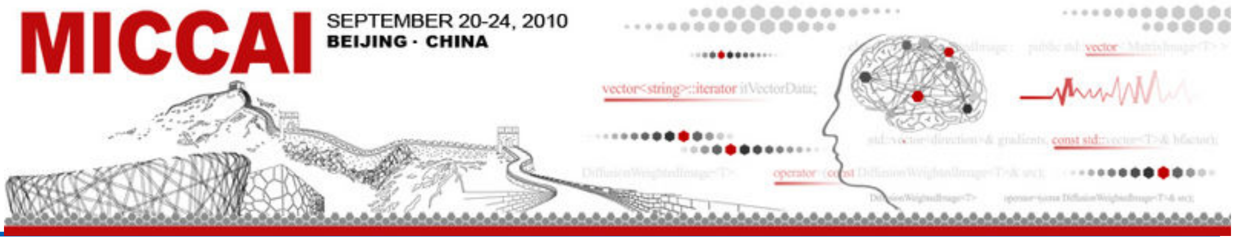


Software Testing with NA-MIC Kit

Xiaodong Tao, Ph.D.

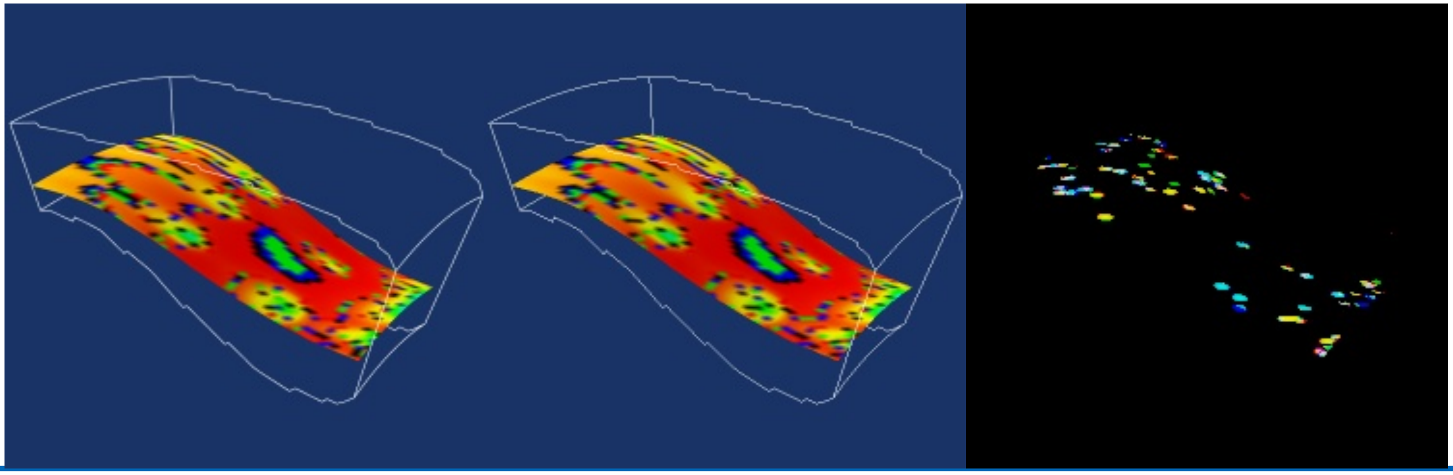
Visualization and Computer Vision Lab
GE Global Research Center

Why Test Daily?

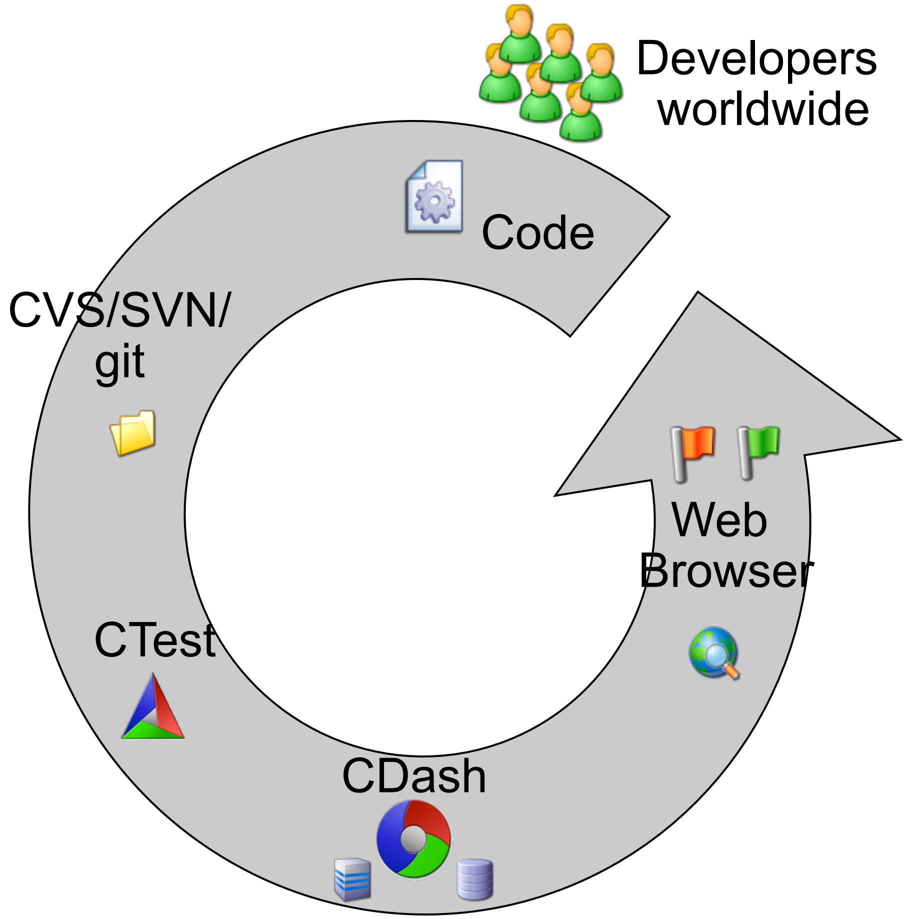
- Large code base too large for any single developer to understand
- Developers distributed around the world
- Identify problems as they occur
- Insure that object API remains unchanged
- Provide feedback to developers as they experiment with new implementations

Regression Testing

- Compare generated image against image from baseline implementation
  - – pixel-by-pixel comparison
  - – can use a threshold metric
  - – adjusted for effects like dithering

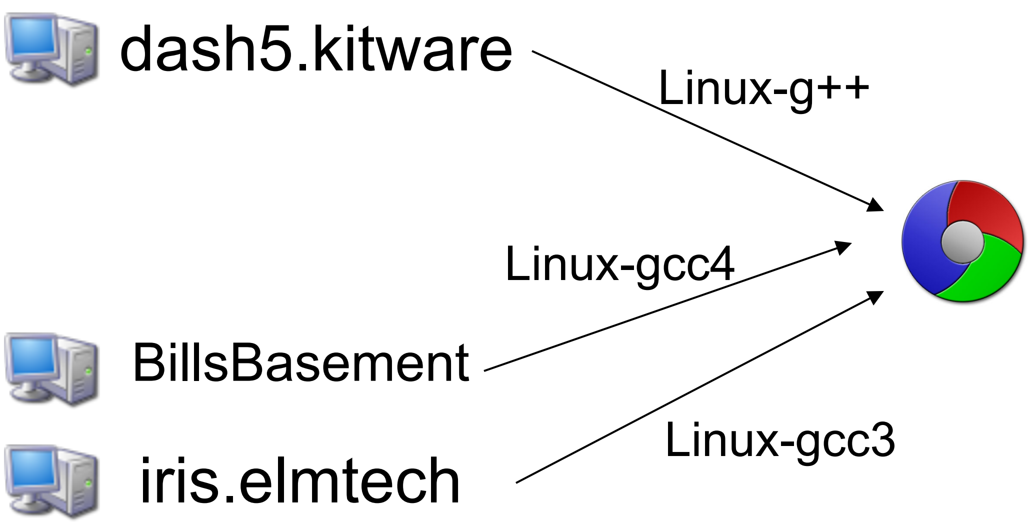


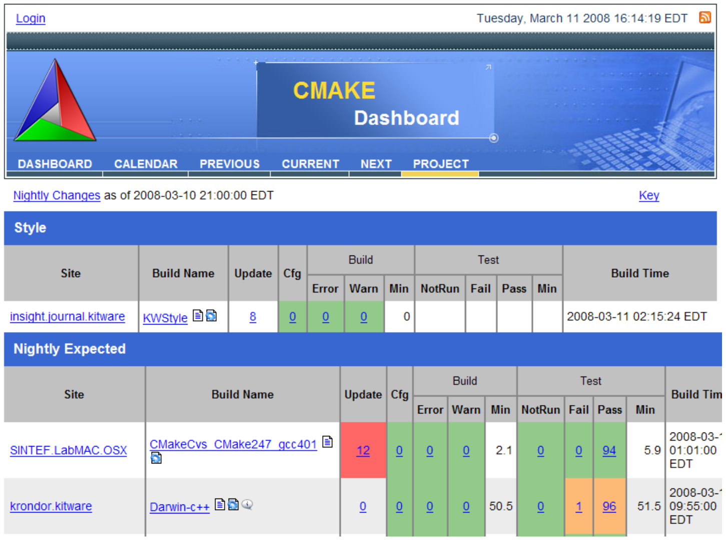
Software Development Cycle



Testing Terminology

Sites Builds





Tuesday, March 11 2008 16:14:19 EDT

Nightly Changes as of 2008-03-10 21:00:00 EDT

Style

Site	Build Name	Update	Cfg	Build			Test				Build Time
				Error	Warn	Min	NotRun	Fail	Pass	Min	
insight.journal.kitware	KWStyle	8	0	0	0	0					2008-03-11 02:15:24 EDT

Nightly Expected

Site	Build Name	Update	Cfg	Build			Test				Build Tim
				Error	Warn	Min	NotRun	Fail	Pass	Min	
SINTEF.LabMAC.OSX	CMakeCvs_CMake247_gcc401	12	0	0	0	2.1	0	0	94	5.9	2008-03-1 01:01:00 EDT
krondor.kitware	Darwin-c++	0	0	0	0	50.5	0	1	96	51.5	2008-03-1 09:55:00 EDT

Dashboard

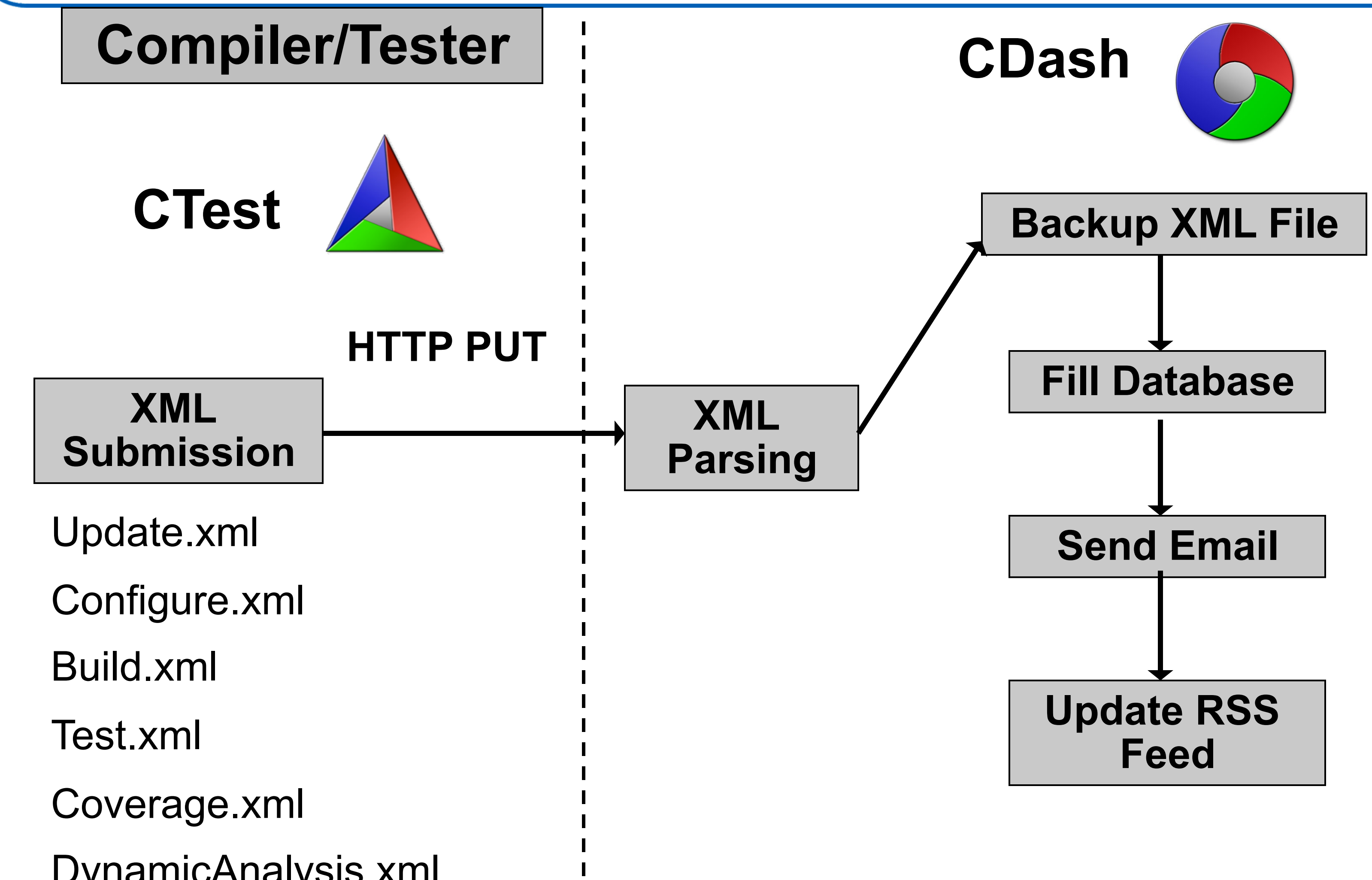
Tools in NA-MIC Kit

CMake, CTest, and CDash

- Testing client
- Distributed with CMake
- Submit test results to the dashboard
- XML submission
- Independent of CMake

- New generation of Dart
- Written in Php/ Javascript
- MySQL
- Open Source
- Run on top of a web server
- XSL implementation
- Web 2.0

Testing Submission



Compiler/Tester

CTest

HTTP PUT

XML Submission

Update.xml

Configure.xml

Build.xml

Test.xml

Coverage.xml

DynamicAnalysis.xml

CDash

XML Parsing

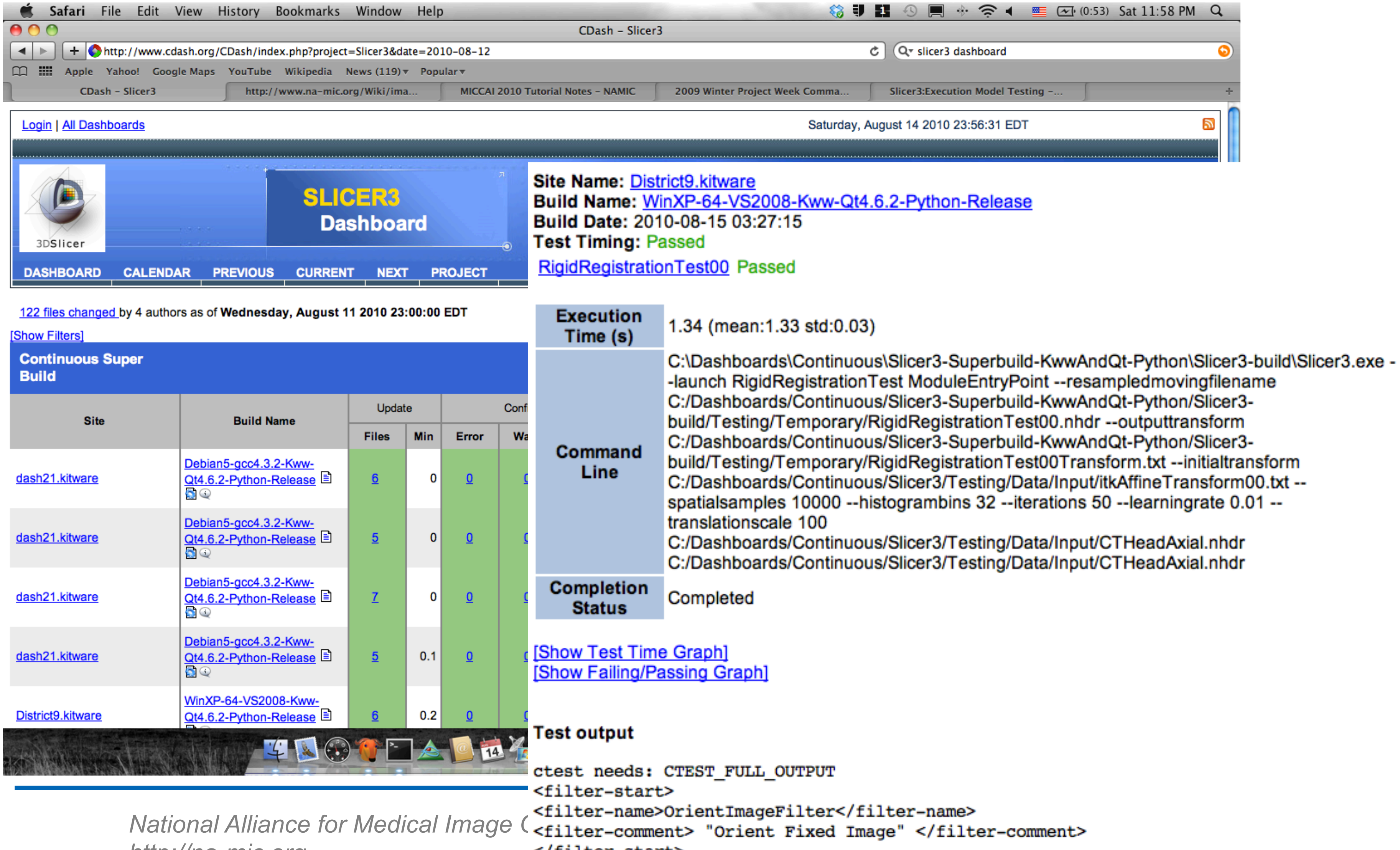
Backup XML File

Fill Database

Send Email

Update RSS Feed

Slicer3 Dashboard


Safari File Edit View History Bookmarks Window Help
(0:53) Sat 11:58 PM
CDash - Slicer3
http://www.cdash.org/CDash/index.php?project=Slicer3&date=2010-08-12
slicer3 dashboard
Apple Yahoo! Google Maps YouTube Wikipedia News (119) Popular
CDash - Slicer3
http://www.na-mic.org/Wiki/ima...
MICCAI 2010 Tutorial Notes - NAMIC
2009 Winter Project Week Comma...
Slicer3:Execution Model Testing -...
Login | All Dashboards
Saturday, August 14 2010 23:56:31 EDT
3DSlicer
SLICER3
Dashboard
DASHBOARD
CALENDAR
PREVIOUS
CURRENT
NEXT
PROJECT

122 files changed by 4 authors as of **Wednesday, August 11 2010 23:00:00 EDT**

[Show Filters]

Continuous Super Build

Site	Build Name	Update		Conf	
		Files	Min	Error	Wa
dash21.kitware	Debian5-gcc4.3.2-Kww-Qt4.6.2-Python-Release	6	0	0	
dash21.kitware	Debian5-gcc4.3.2-Kww-Qt4.6.2-Python-Release	5	0	0	
dash21.kitware	Debian5-gcc4.3.2-Kww-Qt4.6.2-Python-Release	7	0	0	
dash21.kitware	Debian5-gcc4.3.2-Kww-Qt4.6.2-Python-Release	5	0.1	0	
District9.kitware	WinXP-64-VS2008-Kww-Qt4.6.2-Python-Release	6	0.2	0	

Site Name: District9.kitware
Build Name: WinXP-64-VS2008-Kww-Qt4.6.2-Python-Release
Build Date: 2010-08-15 03:27:15
Test Timing: Passed

RigidRegistrationTest00 Passed

Execution Time (s)	1.34 (mean:1.33 std:0.03)
Command Line	C:\Dashboards\Continuous\Slicer3-Superbuild-KwwAndQt-Python\Slicer3-build\Slicer3.exe --launch RigidRegistrationTest ModuleEntryPoint --resampledmovingfilename C:/Dashboards/Continuous/Slicer3-Superbuild-KwwAndQt-Python/Slicer3-build/Testing/Temporary/RigidRegistrationTest00.nhdr --outputtransform C:/Dashboards/Continuous/Slicer3-Superbuild-KwwAndQt-Python/Slicer3-build/Testing/Temporary/RigidRegistrationTest00Transform.txt --initialtransform C:/Dashboards/Continuous/Slicer3/Testing/Data/Input/itkAffineTransform00.txt --spatialsamples 10000 --histogrambins 32 --iterations 50 --learningrate 0.01 --translationscale 100 C:/Dashboards/Continuous/Slicer3/Testing/Data/Input/CTHeadAxial.nhdr C:/Dashboards/Continuous/Slicer3/Testing/Data/Input/CTHeadAxial.nhdr
Completion Status	Completed

[Show Test Time Graph]
[Show Failing/Passing Graph]

Test output

```
ctest needs: CTEST_FULL_OUTPUT
<filter-start>
<filter-name>OrientImageFilter</filter-name>
<filter-comment> "Orient Fixed Image" </filter-comment>
</filter-start>
<filter-end>
```

http://www.cdash.org/CDash/index.php?project=Slicer3

How to write a good test?

- Use empirical values (5/2=2.5)
- Test all of the use cases you can think of (even the boring/most difficult ones)
- Make your tests as efficient as possible
- Have someone else write the test for your algorithm

Contributing Code to Slicer3

Slicer Libs	• ModuleDescriptionParser • GenerateCLP • vtkITK • MRML	Non-slicer specific support libraries
Slicer Base	• Application logic • Widgets	Common infrastructure for Slicer applications
Built in modules	• Slice viewers • Models • Fiducials • Transforms	Full access to Slicer internals
Loadable modules	• Query Atlas • QDEC • Volume rendering • ChangeTracker • EMSegment	Full access to Slicer internals
Scripted modules	• Editor • Teem Two Tensor Tractography • VMTK	Limited access to Slicer internals
Command line modules	• Registration	Restricted access to Slicer internals
Daemon	• OpenIGTLink • Stochastic Tractography	Access to MRML

Steps to Creating CLM Tests

- Creating a Test Driver
- Designing a Test
- Configuring Build and Add the Test
- Configuring the Test
- Run the Test

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Creating a Test Driver

- **C++ Code**

```
#include <iostream>
#include "itkTestMain.h"
void RegisterTests()
{
  REGISTER_TEST
  (CurvatureAnisotropicDiffusionTest);
}
#undef main
#define main CurvatureAnisotropicDiffusionTest
#include "CurvatureAnisotropicDiffusion.cxx"
```

Designing a Test

- Determining what functions to be tested
- Identifying test datasets
- Determining expected or baseline output for functions to be tested
- Covering as many functions as possible
- Covering as many use cases as possible

Configuring Build

- **CMake Code**

```
# CurvatureAnisotropicDiffusion tests
set (CLP CurvatureAnisotropicDiffusion)
add_executable(${CLP}Test ${CLP}Test.cxx)
add_dependencies(${CLP}Test ${CLP})
target_link_libraries(${CLP}Test ITKIO)
```

Add the Test

- **CMake Code**

```
add_test(${CLP}Test ${Slicer3_EXE}
  --launch ${CLP}Test
  --compare ${BASELINE}/${CLP}Test.nhdr
            ${TEMP}/${CLP}Test.nhdr
  ${CLP}Test
    --conductance 2
    --timeStep 0.0625
    --iterations 2
    ${TEST_DATA}/MRHeadResampled.nhdr
    ${TEMP}/${CLP}Test.nhdr  )
```

Configuring and Running the Test

- To configure the Test
  - Using CMake and your favorite compiler

- To run the Test

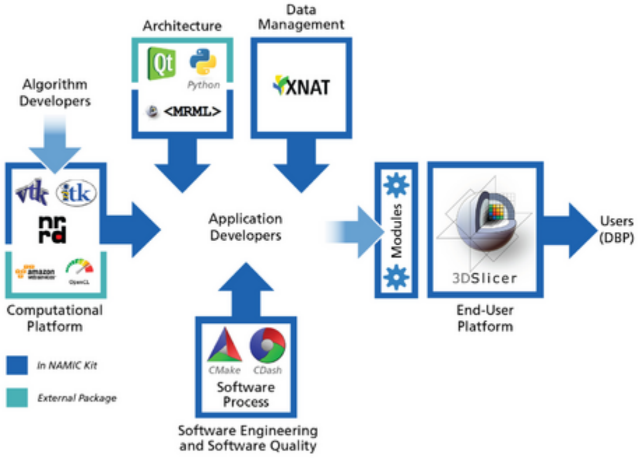
```
ctest -V -R CurvatureAnisotropicDiffusionTest
```

- Start a new cycle

Acknowledgement

National Alliance for Medical Image Computing

NIH U54EB005149



NA-MIC community