OPERA

An Open Source Collaborative
Reduction Pipeline for ESPaDOnS

***O**pen-source **P**ipeline for **E**SPaDOnS **R**eduction and **A**nalysis*

a stretch...

OPERA SCOPE

- Does all that UPENA 1.1 does now
  - Replaces UPENA at CFHT for daily reductions
- Open Source
- Collaborative
- Extensible
- Support EEV1, OLAPA-a and OLAPA-ab

OPEN SOURCE

- Hosted on SourceForge
- Net-based SCM
- Standard Linux Installation and Configuration
- Linux/MacOSX
- Open Source Licensing

COLLABORATIVE

- Managed by CFHT
  - Nadine Manset (project scientist)
  - Eder Martioli (core, libraries)
  - Doug Teeple (harness, libraries, moderator)
  - Kanoa Withington (manager)
- Collaborators from Universities
- And Other Telescopes

PIPELINE

- Harness to command and control the process
  - Flexible to add modules easily
- Core Modules the do calibrations and reductions
  - Essentially the current UPENA pipeline
- Analysis and Post Reduction Modules
  - Optional Modules for pieces that a site may desire
- Software and Data Libraries

HARNESS

- Processing Parameters
- Filepath and filename management
- temp, byproducts and products management
- Aborts, restarts
- Linear and Parallel Pipelines

SOFTWARE LIBRARIES

- data access library
  - common access to calibration and image files
- parameter access library
  - common access to configuration parameters
- image access library

TIMELINE

- Must be done by end of 2013 to be relevant

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The fat lady sings...

OPERA TECHNICAL AND OPERATIONAL REQUIREMENTS

OPERATIONAL

- Linux kernel 2.4
- Must perform core reductions for 400 images within 5 hours
- Support EEV1, OLAPA-a and OLAPA-ab
- High availability
- Autonomous operation
- Core requires verification steps
- Libre-Esprit compatibility

TECHNICAL

- Linux kernel 2.4 perhaps MacOSX 10.6
- All software must be open source and not have dependencies on proprietary libraries or compilers/ interpreters
- Support EEV1, OLAPA-a and OLAPA-ab
- Core must be C/C++ for speed
- Helper scripts
- Core has different requirements than Analysis and post processing

TECHNICAL

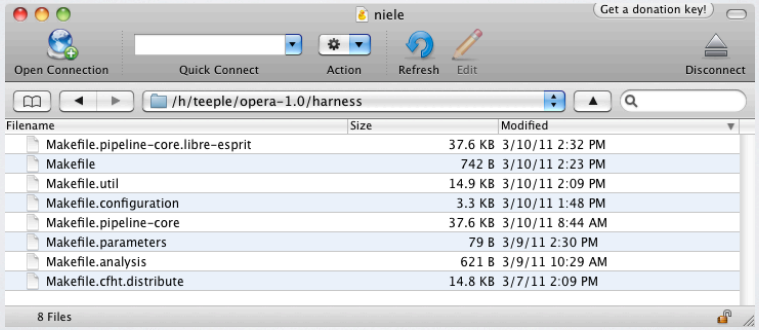
- Module template generator by Eder C/C++
- Harness must support single thread and || reduction
- Harness must support abort-ability and restart-ability with no data corruption
- Harness makes adding Analysis modules relatively simple
- Parameterization
- Configure Access

TECHNICAL

- Single image or batch operation
- Documentation online
- Testing and test data provided by CFHT
- Core Acceptance and testing also provided by CFHT

HARNESS

- Make-based
- linear or parallel operation
- Removes targets on abort so restart is clean



HARNESS

```
##############################################################################################
#
#
# Opera 1.0 parallel multi-machine Makefile
#
# Teeple 3/7/2011
#
# This version implements OLAPA as well as EEV1 modes
#
#
##############################################################################################

include Makefile.configuration
include Makefile.parameters

include Makefile.pipeline-core.libre-esprit

##############################################################################################
# Add Analysis targets here
# e.g. include Makefile.analysis.lsd
##############################################################################################

include Makefile.util
include Makefile.cfht.distribute
include Makefile.analysis
```

MODULE

- A Module is an executable that performs a processing step
- A *processing step* is a single reduction or calibration step
- Should not contain parameter or configuration assumptions
- A *Good* Module:
  - Takes inputs for filename, paths, parameters, as arguments
  - Produces a single output product
  - Does not do anything that precludes || operations:
    - Use unlocked shared memory
    - Generate filenames
    - Test for the existence of a product, byproduct, tempfile

INFRASTRUCTURE

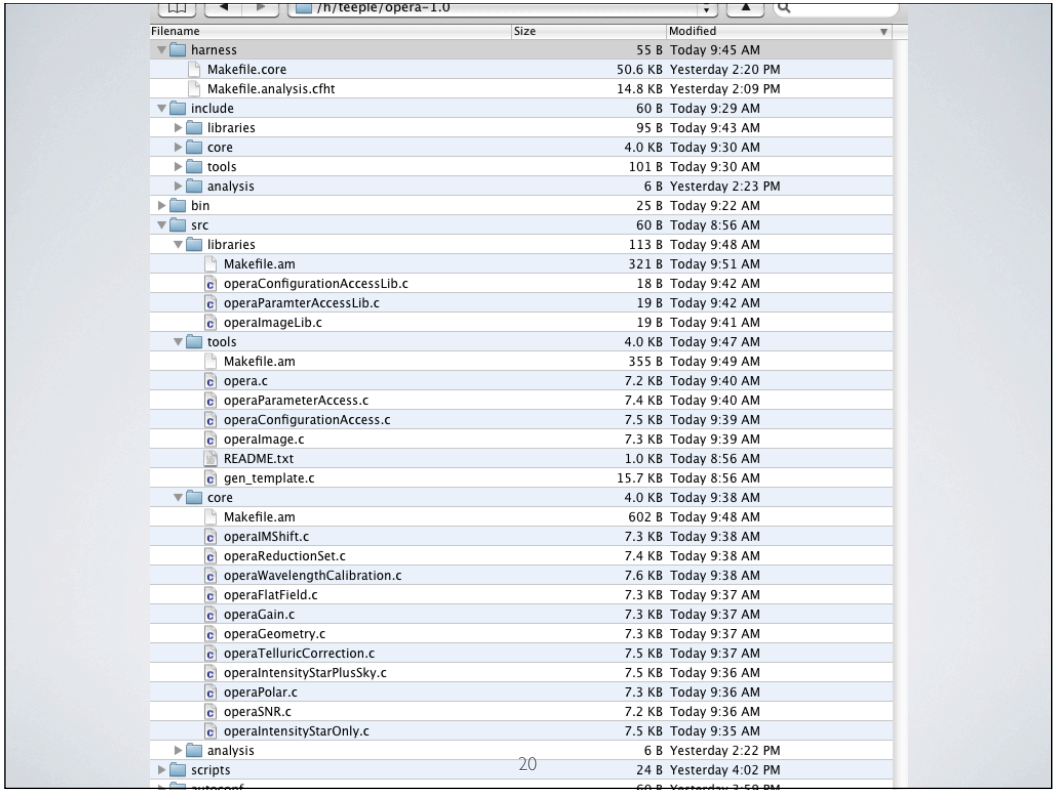
- Web-based CVS source code control
- Hosted on Sourceforge
- Configuration
  - ./autoconf/autogen.sh
  - ./configure --prefix=./opera-1.0
- Installation process (make && make install)

INFRASTRUCTURE

- Use the operaConfiguration tool and operaParameters tool to set up for local your configuration:

```
./bin operaConfiguration --list
./bin operaConfiguration ROOTDIR=$(HOME)/opera-1.0
./bin operaConfiguration --instantiate

./bin operaparameters --list
./bin operaparameters gain_default_OLAPA-a_pol_Normal=3.9
./bin operaConfiguration --instantiate
```


/h/teeple/opera-1.0
Filename
Size
Modified
harness 55 B Today 9:45 AM
Makefile.core 50.6 KB Yesterday 2:20 PM
Makefile.analysis.cfht 14.8 KB Yesterday 2:09 PM
include 60 B Today 9:29 AM
libraries 95 B Today 9:43 AM
core 4.0 KB Today 9:30 AM
tools 101 B Today 9:30 AM
analysis 6 B Yesterday 2:23 PM
bin 25 B Today 9:22 AM
src 60 B Today 8:56 AM
libraries 113 B Today 9:48 AM
Makefile.am 321 B Today 9:51 AM
operaConfigurationAccessLib.c 18 B Today 9:42 AM
operaParamterAccessLib.c 19 B Today 9:42 AM
operaImageLib.c 19 B Today 9:41 AM
tools 4.0 KB Today 9:47 AM
Makefile.am 355 B Today 9:49 AM
opera.c 7.2 KB Today 9:40 AM
operaParameterAccess.c 7.4 KB Today 9:40 AM
operaConfigurationAccess.c 7.5 KB Today 9:39 AM
operaImage.c 7.3 KB Today 9:39 AM
README.txt 1.0 KB Today 8:56 AM
gen_template.c 15.7 KB Today 8:56 AM
core 4.0 KB Today 9:38 AM
Makefile.am 602 B Today 9:48 AM
operaIMShift.c 7.3 KB Today 9:38 AM
operaReductionSet.c 7.4 KB Today 9:38 AM
operaWavelengthCalibration.c 7.6 KB Today 9:38 AM
operaFlatField.c 7.3 KB Today 9:37 AM
operaGain.c 7.3 KB Today 9:37 AM
operaGeometry.c 7.3 KB Today 9:37 AM
operaTelluricCorrection.c 7.5 KB Today 9:37 AM
operaIntensityStarPlusSky.c 7.5 KB Today 9:36 AM
operaPolar.c 7.3 KB Today 9:36 AM
operaSNR.c 7.2 KB Today 9:36 AM
operaIntensityStarOnly.c 7.5 KB Today 9:35 AM
analysis 6 B Yesterday 2:22 PM
scripts 24 B Yesterday 4:02 PM

INFRASTRUCTURE

- Adding a Module opera-1.0/src/analysis/myModule look for Makefile.am:

```
# what flags you want to pass to the C compiler & linker
CFLAGS = --pedantic -Wall -std=c99 -g -L../../lib -L/usr/local/lib/ -I../../include/ -
lcfitsio -lm
CXXFLAGS = --pedantic -Wall -g -L../../lib -I../../include/ -lcfitsio -lm
LDFLAGS =

# this lists the binaries to produce
bin_PROGRAMS = operaGeometry operaIntensityStarPlusSky operaSNR \
          operaFlatField operaIMShift operaPolar operaTelluricCorrection \
          operaGain operaIntensityStarOnly operaReductionSet operaWavelengthCalibration \
          operaRadialVelocity operaFitSN myModule

operaGeometry_SOURCES = operaGeometry.c operaGeometry.h

operaMyModule_SOURCES = operaMyModule.c operaMyModule.h
```

INFRASTRUCTURE

- Adding a Module opera-1.0/src/analysis/myModule

```
cd ~/opera-1.0/
./autoconf autogen.sh
./configure
make

then add your new target(s) to Makefile.analysis
and try it out!

make install

./bin/opera <mynewtarget> --verbose --debug --trace
```

INFRASTRUCTURE

- SourceForge setup -- still needs a lot of work
- userids
- mailing lists
- CVS pserver setup

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