Bisque and iRods
Center for Bio-Image Informatics, UCSB
http://bovary.iplantcollaborative.org
Kris Kvilekval
Automated analysis

Visualization

Ground truth

Flexible and hierarchical annotations

Bisque - Image database

Generic statistics

Automated analysis

Flexible and hierarchical annotations

Visualization

Ground truth
Bisque basics

• Support varying data models
  • Database supports dynamic data model

• Everything is a web accessible resource
  • Image, Metadata, Analysis, Index

• Scalable and distributed
  • Add servers
  • Combine and use multiple diverse collections

• Rich web clients for interactive analysis
  • Web based applications
Flexible and hierarchical

- Hierarchical structure
- Flexible name:value fields
- Textual and 5D graphical annotations
- Biologically meaningful objects and groups

"Bisque: A Platform for Bioimage Analysis and Management", Bioinformatics, Feb. 2010
Bisque architecture

Client tools

- Python
- Java

Scalable services

- Image Services
- Data Services
- Analysis Services

Client tools:
- XML, JSON, HTML

Scalable services:
- XML

Client Services
Analysis Challenges

- Local machines
- Local/Remote clusters
- Environment
- Datasets
- Storage hierarchies
- Movement
- Local machines
- Local/Remote clusters
- Environment
- Language Neutral
- Local development
- Distribution

- Data organization and access
- Using Computational Resources
- Development methods
HT-Imaging Challenges

Automated imaging can produce large-scale data

- Minimize data movement
- Protection/Ownership
- Integration with current workflow
- Metadata collection and binding
- Automated analysis
HT-Imaging

Automated Imaging

Bisque

Image discovery → Metadata binding → Initial Analysis
Image ingest

 ✓ Discovery: iRules based or Polling
 ✓ Pre-processing: unpacking/construction
 ✓ Initial analysis: resource based

Data sources:
- iRods
- Local disk
- Uploads

Data types:
- Images/Files
- Metadata Records
- Experimental Objects
Discovery with iRods

iRods client:
  iPut, iDrop
  /home/$user/bisque_data

Bisque insert script

iRods URL

Image

Fueled by:

Bisque

Image
Example Rules for registering irods rules.

```
### server/config/reConfigs/core.re
### Example Rules for registering irods rules.
#
acPostProcForPut {
    ON ($userNameClient != "bisque" && $objPath like "/iplant/home/\*/bisque_data/\*") {
        writeLine("serverLog","BISQUE: inserting object"++$objPath);
        delay("<PLUSET>1s</PLUSET><EF>1s REPEAT UNTIL SUCCESS</EF>") {
            delay("<PLUSET>1s</PLUSET>") {
                msiExecCmd("insert2bisque.py", "$objPath $userNameClient", "winwood.iplantcollaborative.org", "null", "null", *cmdOut);
                writeLine("serverLog","BISQUE: inserted object"++$objPath);
            }
        }
    }
}
acPostProcForCollCreate {
    ON ($collName like "/iplant/home/$userNameClient/bisque_data") {
        writeLine("serverLog","BISQUE: permitting bisque user RW on"++$collName);
        msiSetACL ('default', 'write', 'bisque', $collName);
        msiSetACL ('recursive', 'inherit', 'null', $collName);
    }
}
```
#!/usr/bin/env python
import sys
import shlex
import urllib
import urllib2
import urlparse
import base64
import logging

############################
# Config for local installation
LOGFILE='/tmp/bisque_insert.log'
BISQUE_HOST='http://bisque.ece.ucsb.edu'
BISQUE_ADMIN_PASS='guessme'
IRODS_HOST='irods://irods.ece.ucsb.edu'
# End Config

logging.basicConfig(filename=LOGFILE, level=logging.INFO)
log = logging.getLogger('i2b')

def main():
    log.debug("insert2bisque received %s" % (sys.argv) )
    try:
        obj = sys.argv[1]
        user = sys.argv[2]
        url = "%s/import/insert?%s" % (BISQUE_HOST, urllib.urlencode( { 'url': IRODS_HOST+obj, 'user': user} ))
        request = urllib2.Request(url)
        request.add_header('authorization', 'Basic ' + base64.encodestring("admin:%s" % BISQUE_ADMIN_PASS ).strip())
        r = urllib2.urlopen(request)
        response = r.read()
        log.info('insert %s -> %s' % (url, response))
    except Exception,e:
        log.exception("exception occurred %s" % e )
        raise e

if __name__ == "__main__":
    main()
    sys.exit(0)
HT image pre-processing/analysis

Image processing

Bisque

Condor
High Throughput Computing
Challenges

• Pre-processing ops require local files
  • ex: unpacking and image construction
  • Should it move to iRods server?

• Analysis also requires local files
  • Should it also move to iRods server?

• Should an IS run on the iRods server?

• iRods on clusters?
BQPhytomorph

Bisque
B.S. Manjunath
Kris Kvelikval
Dmitry Fedorov

Phytomorph
Edgar Spalding
Nathan Miller
Logan Johnson
Whole Seedling-size Analysis

Source: Edgar Spalding
Seed Size Features

Major Axis

Minor Axis

Area

Source: Edgar Spalding
Root Tip Angle

Cvi  Ler

164 lines
X 10 seedlings/line
1640 movies

9 h after gravistimulation

QTL of gravitropism

Source: Edgar Spalding
Experimental Setup

Seeds Planted

1 mM KCl, 1 mM CaCl₂, 5 mM MES, pH 5.7

2-4 day Stratification

2-4°C

3 days in growth chamber

contant white light, 22.5°C

Record Initial Root Lengths

Place in front of camera in CCW orientation

Image at 100 px/mm every 2 min for 8 hr

Source: Edgar Spalding
Multi-Tip and Growth-Rate

Cape Verde Islands

Landsberg erecta

Tip Angle

Average Growth Rate

Source: Edgar Spalding