“epiphyte”
Joint effort:

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exploratory
open
participatory
exploratory

openatory

participatory
We share data at yt-project.org, and usually this means giving access via ssh keys, which is moderately annoying.

Then, this data gets downloaded and looked at locally.

We wanted to avoid all the annoying bits of this by making it easy to upload, and easy to analyze the data.
These datasets are provided for experimentation and testing purposes only. They do not necessarily reflect any published work or scientific consistency.

<table>
<thead>
<tr>
<th>Filename</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D9p_500</td>
<td>343 MB</td>
<td>Hydro cosmological zoom-in simulation of a dwarf galaxy. NMSU-ART Dataset.</td>
</tr>
<tr>
<td>DMonly</td>
<td>1 GB</td>
<td>Dark Matter only cosmological NMSU-ART Dataset.</td>
</tr>
<tr>
<td>sizmbhloz-clref04SNth-rs9_a0.9011</td>
<td>93 MB</td>
<td>Isolated galaxy with particles and gas.</td>
</tr>
<tr>
<td>MHDSloshing</td>
<td>1.5 GB</td>
<td>Gas sloshing with MHD, with static mesh refinement. &quot;time_unit&quot;:(1.0,&quot;Myr&quot;), &quot;length_unit&quot;:(1.0,&quot;Mpc&quot;), &quot;mass_unit&quot;:(1.0e14,&quot;Msun&quot;)</td>
</tr>
<tr>
<td>MHDBlast</td>
<td>283 MB</td>
<td>Time series data of a MHD blast simulation.</td>
</tr>
<tr>
<td>RamPressureStripping</td>
<td>2.1 GB</td>
<td>MHD simulation of a ram pressure-stripped galaxy, from Stephanie Tornenesen. &quot;time_unit&quot;:3.086e14, &quot;length_unit&quot;:8.0236e22, &quot;mass_unit&quot;:5.1649293e+39</td>
</tr>
<tr>
<td>ShockCloud</td>
<td>104 MB</td>
<td>Hydro simulation of shock interacting with a cloud, with static mesh refinement.</td>
</tr>
<tr>
<td>castro_sod_x_plt00036</td>
<td>9.9 kB</td>
<td>Sod problem, 1-d dataset, 3 levels</td>
</tr>
<tr>
<td>castro_sedov_2d_cyl_in_cart_plt00150</td>
<td>4.6 kB</td>
<td>Sedov problem, 2-d dataset, 4 levels</td>
</tr>
</tbody>
</table>
It's awkwardly sized: not so huge, but not emailable. And it's bigger than Dropbox wants to give out for free. We get data from lots of people from different resources and computational access.
postulate:

for this to be worthwhile, people have to use it.
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for people to use it, it must have zero barriers to entry.
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for people to love it, it must make hard things easy.
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we have to go where people already are.
motivation / desires
motivation / desires

submit
analyze
curate
annotate
link

Data
Use Case 1:

Large data is stored at NDS-EpiphYTE, citable, and we want to make analysis accessible in a non-interactive fashion.

(submit a script, get a plot)
$ epiphyte run my_script.py
Running...
Job id: 329314821

$ epiphyte get_results 329314821
Use Case 2:

Data is stored at NDS-EpiphYTE, and we make available interactive analysis and visualization of that data.

(IPython notebooks, RStudio, …)
Simple Visualizations of Data

Just like in our first notebook, we have to load yt and then some data.

In [ ]: import yt

For this notebook, we'll load up a cosmology dataset.

In [ ]: ds = yt.load("enzo_tiny_cosmology/DD0046/DD0046")
print "Redshift =", ds.current_redshift

In the terms that yt uses, a projection is a line integral through the domain. This can either be unweighted (in which case a column density is returned) or weighted, in which case an average value is returned. Projections are, like all other data objects in yt, full-fledged data objects that churn through data and present that to you. However, we also provide a simple method of creating Projections and plotting them in a single step. This is called a Plot Window, here specifically known as a ProjectionPlot. One thing to note is that in yt, we project all the way through the entire domain at a single time. This means that the first call to projecting can be somewhat time consuming, but panning, zooming and plotting are all quite fast.

yt is designed to make it easy to make nice plots and straightforward to modify those plots directly. The cookbook in the documentation includes detailed examples of this.

In [ ]: p = yt.ProjectionPlot(ds, "y", "density")
p.show()

The show command simply sends the plot to the IPython notebook. You can also call p.save() which will save the plot to the file system. This function accepts an argument, which will be pre-prended to the filename and can be used to name it based on the width or to supply a location.

Now we'll zoom and pan a bit.
Use Case 3:

Individual research communities store collections of data, in front of which they want to place compute-heavy webapps.

(Queries, correlations, …)
Click an element to see the pieces of data that go into the calculation.
Use Case 4:

Interactive, collaborative development of analysis and visualization of data, deployed on NDS-Epiphyte resources.

(coLaboratory, Cloud9 IDE, ...)

```python
import yt
import numpy as np
from darksky_catalog import darksky
center = np.array([-2565805.31114929, -3517306.7572399, -1639170.70554688])
radius = 50.0e3  # 100 Mpc width
bbox = np.array([center - radius, center + radius])
ds = darksky['ds14 a'].load(midx=10, bounding_box=bbox)
p = yt.ProjectionPlot(ds, 0, 'dark matter density', weight_field=None)
p.show()
```
```c
#include "FixedInterpolator.h"


npy_float64 fast_interpolate(int ds[3], int ci[3], npy_float64 dp[3], 
npy_float64 *data)
{
    int i;
    npy_float64 dv, dm[3];
    For(i=0;i<3;i++) dm[i] = (1.0 - dp[i]);
    dv = 0.0;
    dv += VINDEX(0,0,0) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(0,0,1) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(0,1,0) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(1,0,0) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(0,1,1) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(1,0,1) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(1,1,0) * (dm[0]*dm[1]*dm[2]);
    dv += VINDEX(1,1,1) * (dm[0]*dm[1]*dm[2]);
    /*assert(dv < -20);*/
    return dv;
}

npy_float64 offset_interpolate(int ds[3], npy_float64 dp[3], npy_float64 *data)
{
    int i;
    npy_float64 dv, vz[4];
    dv = 1.0 - dp[2];
    vz[0] = dv*VINDEX(0,0,0) + dp[2]*VINDEX(0,0,1);
    vz[1] = dv*VINDEX(0,0,1) + dp[2]*VINDEX(0,1,0);
    vz[2] = dv*VINDEX(0,1,0) + dp[2]*VINDEX(1,0,0);
    vz[3] = dv*VINDEX(1,0,0) + dp[2]*VINDEX(1,1,0);
    dv = 1.0 - dp[1];
    vz[0] = dv*vz[0] + dp[1]*vz[1];
```
• Non-interactive
• Interactive
• Outward-facing
• Collaborative
Cloud

- Document Manager
- Identity System
- Storage

Dynamically Provisioned Containers

- Analysis Jobs
- Storage Access (iRODS, FUSE, db)

Access Portal
- Analysis Portal
- Collection Portals

Globus, scp, bbcp, etc
requirements:

swappable components
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swappable components

open source, open development
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swappable components

open source, open development

standards for interoperability (OAI-ORE)
Inspired by NDS1, we decided to explore a Platform-as-a-Service for data analysis.

What could we do with a service oriented architecture and sufficient motivation?
Humility.
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We must evaluate existing technologies, utilize them where appropriate, and remain flexible enough to allow future inclusion and utilization.
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Dataverse, Docker, DSpace, Globus Nexus, InCommon, Invenio, iPlant, iRODS, Medici2, mesos, Open Science Framework, ownCloud, ResearchCompendia, SciDrive, SEAD, many many more...
A Near-Term Vision:

Storage and documents are easily federated.

- iRODS
- Scidrive
- S3/Swift

Storage interface

- ownCloud

Document catalog

- Invenio

Dashboard, collector, analysis, collection portals

Interface

Event Bus

globus http scp
Interface

Dashboard, collector, analysis, collection portals
● Non-interactive
● Interactive
● Outward-facing
● Collaborative
Interested?

discuss@nationaldataservice.org
http://bitbucket.org/nds-org/
#nds-epiphyte / chat.freenode.net