16.3: VISUALIZING MAIL DATA

Contributed by Chuck Severance
Clinical Associate Professor (School of Information) at University of Michigan

Up to this point in the book, you have become quite familiar with our *mbox-short.txt* and *mbox.txt* data files. Now it is time to take our analysis of email data to the next level.

In the real world, sometimes you have to pull down mail data from servers. That might take quite some time and the data might be inconsistent, error-filled, and need a lot of cleanup or adjustment. In this section, we work with an application that is the most complex so far and pull down nearly a gigabyte of data and visualize it.

A Word Cloud from the Sakai Developer List

You can download this application from:

www.py4e.com/code3/gmane.zip

We will be using data from a free email list archiving service called www.gmane.org. This service is very popular with open source projects because it provides a nice searchable archive of their email activity. They also have a very liberal policy regarding accessing

their data through their API. They have no rate limits, but ask that you don't overload their service and take only the data you need. You can read gmane's terms and conditions at this page:

http://gmane.org/export.php

It is very important that you make use of the gmane.org data responsibly by adding delays to your access of their services and spreading long-running jobs over a longer period of time. Do not abuse this free service and ruin it for the rest of us.

When the Sakai email data was spidered using this software, it produced nearly a Gigabyte of data and took a number of runs on several days. The file *README.txt* in the above ZIP may have instructions as to how you can download a pre-spidered copy of the *content.sqlite* file for a majority of the Sakai email corpus so you don't have to spider for five days just to run the programs. If you download the pre-spidered content, you should still run the spidering process to catch up with more recent messages.

The first step is to spider the gmane repository. The base URL is hard-coded in the *gmane.py* and is hard-coded to the Sakai developer list. You can spider another repository by changing that base url. Make sure to delete the *content.sqlite* file if you switch the base url.

The *gmane.py* file operates as a responsible caching spider in that it runs slowly and retrieves one mail message per second so as to avoid getting throttled by gmane. It stores all of its data in a database and can be interrupted and restarted as often as needed. It may take many hours to pull all the data down. So you may need to restart several times.

Here is a run of *gmane.py* retrieving the last five messages of the Sakai developer list:

```
How many messages:10
http://download.gmane.org/gmane.comp.cms.sakai.devel/51410/51411 9460
    nealcaidin@sakaifoundation.org 2013-04-05 re: [building ...
http://download.gmane.org/gmane.comp.cms.sakai.devel/51411/51412 3379
    samuelgutierrezjimenez@gmail.com 2013-04-06 re: [building ...
http://download.gmane.org/gmane.comp.cms.sakai.devel/51412/51413 9903
    da1@vt.edu 2013-04-05 [building sakai] melete 2.9 oracle ...
http://download.gmane.org/gmane.comp.cms.sakai.devel/51413/51414 349265
    m.shedid@elraed-it.com 2013-04-07 [building sakai] ...
http://download.gmane.org/gmane.comp.cms.sakai.devel/51414/51415 3481
    samuelgutierrezjimenez@gmail.com 2013-04-07 re: ...
http://download.gmane.org/gmane.comp.cms.sakai.devel/51415/51416 0

Does not start with From
```

The program scans *content.sqlite* from one up to the first message number not already spidered and starts spidering at that message. It continues spidering until it has spidered the desired number of messages or it reaches a page that does not appear to be a properly formatted message.

Sometimes gmane.org is missing a message. Perhaps administrators can delete messages or perhaps they get lost. If your spider stops, and it seems it has hit a missing message, go into the SQLite Manager and add a row with the missing id leaving all the other fields blank and restart *gmane.py*. This will unstick the spidering process and allow it to continue. These empty messages will be ignored in the next phase of the process.

One nice thing is that once you have spidered all of the messages and have them in *content.sqlite*, you can run *gmane.py* again to get new messages as they are sent to the list.

The *content.sqlite* data is pretty raw, with an inefficient data model, and not compressed. This is intentional as it allows you to look at *content.sqlite* in the SQLite Manager to debug problems with the spidering process. It would be a bad idea to run any queries against this database, as they would be quite slow.

The second process is to run the program *gmodel.py*. This program reads the raw data from *content.sqlite* and produces a cleaned-up and well-modeled version of the data in the file *index.sqlite*. This file will be much smaller (often 10X smaller) than *content.sqlite* because it also compresses the header and body text.

Each time *gmodel.py* runs it deletes and rebuilds *index.sqlite*, allowing you to adjust its parameters and edit the mapping tables in *content.sqlite* to tweak the data cleaning process. This is a sample run of *gmodel.py*. It prints a line out each time 250 mail messages are processed so you can see some progress happening, as this program may run for a while processing nearly a Gigabyte of mail data.

```
Loaded allsenders 1588 and mapping 28 dns mapping 1
1 2005-12-08T23:34:30-06:00 ggolden22@mac.com
251 2005-12-22T10:03:20-08:00 tpamsler@ucdavis.edu
501 2006-01-12T11:17:34-05:00 lance@indiana.edu
751 2006-01-24T11:13:28-08:00 vrajgopalan@ucmerced.edu
...
```

The *gmodel.py* program handles a number of data cleaning tasks.

Domain names are truncated to two levels for .com, .org, .edu, and .net. Other domain names are truncated to three levels. So si.umich.edu becomes umich.edu and caret.cam.ac.uk becomes cam.ac.uk. Email addresses are also forced to lower case, and some of the @gmane.org address like the following

```
arwhyte-63aXycvo3TyHXe+LvDLADg@public.gmane.org
```

are converted to the real address whenever there is a matching real email address elsewhere in the message corpus.

In the *content.sqlite* database there are two tables that allow you to map both domain names and individual email addresses that change over the lifetime of the email list. For example, Steve Githens used the following email addresses as he changed jobs over the life of the Sakai developer list:

```
s-githens@northwestern.edu
sgithens@cam.ac.uk
swgithen@mtu.edu
```

We can add two entries to the Mapping table in *content.sqlite* so *gmodel.py* will map all three to one address:

```
s-githens@northwestern.edu ->  swgithen@mtu.edu
sgithens@cam.ac.uk -> swgithen@mtu.edu
```

You can also make similar entries in the DNSMapping table if there are multiple DNS names you want mapped to a single DNS. The following mapping was added to the Sakai data:

```
iupui.edu -> indiana.edu
```

so all the accounts from the various Indiana University campuses are tracked together.

You can rerun the *gmodel.py* over and over as you look at the data, and add mappings to make the data cleaner and cleaner. When you are done, you will have a nicely indexed version of the email in *index.sqlite*. This is the file to use to do data analysis. With this file, data analysis will be really quick.

The first, simplest data analysis is to determine "who sent the most mail?" and "which organization sent the most mail"? This is done using *gbasic.py*:

```
How many to dump? 5
Loaded messages= 51330 subjects= 25033 senders= 1584

Top 5 Email list participants
steve.swinsburg@gmail.com 2657
azeckoski@unicon.net 1742
ieb@tfd.co.uk 1591
csev@umich.edu 1304
david.horwitz@uct.ac.za 1184

Top 5 Email list organizations
gmail.com 7339
umich.edu 6243
uct.ac.za 2451
indiana.edu 2258
unicon.net 2055
```

Note how much more quickly *gbasic.py* runs compared to *gmane.py* or even *gmodel.py*. They are all working on the same data, but *gbasic.py* is using the compressed and normalized data in *index.sqlite*. If you have a lot of data to manage, a multistep process like the one in this application may take a little longer to develop, but will save you a lot of time when you really start to explore and visualize your data.

You can produce a simple visualization of the word frequency in the subject lines in the file *gword.py*:

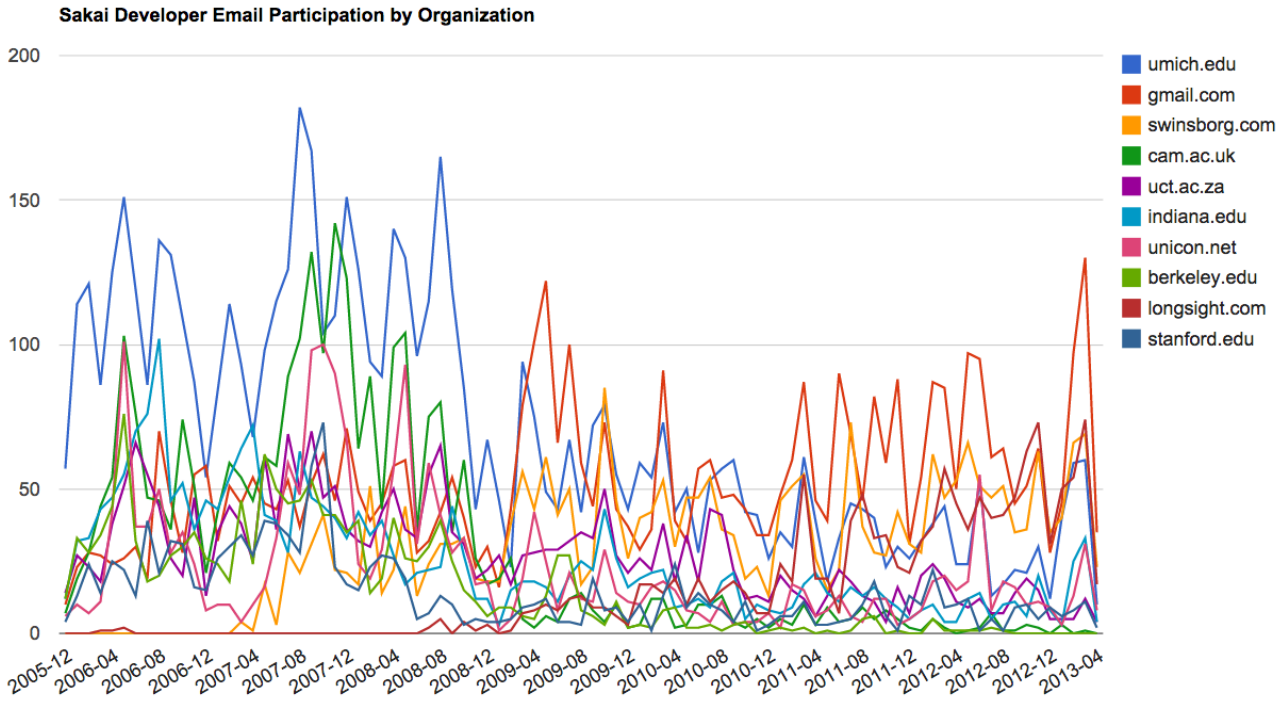
```
Range of counts: 33229 129
Output written to gword.js
```

This produces the file *gword.js* which you can visualize using *gword.htm* to produce a word cloud similar to the one at the beginning of this section.

A second visualization is produced by *gline.py*. It computes email participation by organizations over time.

```
Loaded messages= 51330 subjects= 25033 senders= 1584
Top 10 Oranizations
['gmail.com', 'umich.edu', 'uct.ac.za', 'indiana.edu',
'unicon.net', 'tfd.co.uk', 'berkeley.edu', 'longsight.com',
'stanford.edu', 'ox.ac.uk']
Output written to gline.js
```

Its output is written to *gline.js* which is visualized using *gline.htm*.



Sakai Mail Activity by Organization

This is a relatively complex and sophisticated application and has features to do some real data retrieval, cleaning, and visualization.