Reading WARC Records with Mathematica

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Step One: Import the File and Set up a Record

```
sampleWARCFile =
  "/Users/ianmilligan1/dropbox/git/warcbase-resources/Sample-Data/ARCHIVEIT-227-
    QUARTERLY-XUGECV-20091218231727-00039-crawling06.us.archive.org-8091.warc.
    txt";
```

```
wFile = OpenRead[sampleWARCFile];
```

```
recordToAssociation[rec_] :=
 Module[{recmod, fields, vals},
  recmod = StringReplace[rec, "\r\n\r\n" → "\r\n\r\nCONTENT: "];
  fields = StringTrim[StringExtract[StringSplit[recmod, "\r"], ":" → 1]];
  vals = Map[
    StringTrim[StringReplace[#, Shortest[StartOfString ~~ Except[":"] ..] ~~ ":" →
        ""]] &, StringSplit[recmod, "\r"]];
  Return[Association[DeleteCases[MapThread[Rule, {fields, vals}],
     Rule["", ""] | Rule["CONTENT", ""]]]]]
```

Step Two: Examine the First Records, To Get a Sense of Content

```
tempRecord = Read[wFile, Record, RecordSeparators → {"WARC/1.0" }];
```

```
tempRecordAssociation = recordToAssociation[tempRecord];
```

```
Keys[tempRecordAssociation]
```

```
{WARC-Type, WARC-Date, WARC-Filename, WARC-Record-ID, Content-Type,
 Content-Length, CONTENT, ip, hostname, format, conformsTo, operator, publisher,
 isPartOf, description, robots, http-header-user-agent, http-header-from}
```

Step Three: Process Content of WARC as Stream, Visualize Metadata Results

Given the list of keys above, sub out in the following. The first step will be to check questions such as hosts. This does so by going through the WARC file, finding all the associations with “Host” and picking them out.

The next command then tallies and prepares them to be visualized, as you see in the PieChart below. This same process can be repeated for others - Content-Type, for example, hostname, operator, publisher, etc. etc. It’s quite flexible. It requires a fair bit of memory and you may see your system overheat.

Interestingly enough, content extraction on many WARCs is quicker.

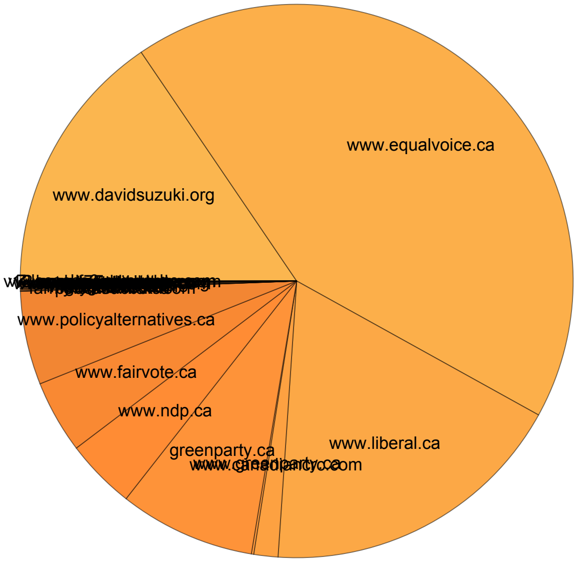
```
SetStreamPosition[wFile, 1]; (** set the position at 1 **)
```

```
hosts = Reap[
   While[(tempRecord = Read[wFile, Record, RecordSeparators → {"WARC/1.0"}]) =!=
     EndOfFile, tempRecordAssociation = recordToAssociation[tempRecord];
    Sow[tempRecordAssociation["Host"]];
   ]];
```

```
hostfrequency = Tally[Cases[Flatten[hosts⟦2⟧], Except[_Missing]]]
```

```
{{v7.lscache3.c.youtube.com, 2}, {www.davidsuzuki.org, 1689},
 {www.equalvoice.ca, 4644}, {www.liberal.ca, 1968}, {www.canadiancrc.com, 154},
 {www.greenparty.ca, 15}, {greenparty.ca, 869}, {www.ndp.ca, 447},
 {www.fairvote.ca, 465}, {www.policyalternatives.ca, 596},
 {podcast.cbc.ca, 1}, {farm3.static.flickr.com, 4}, {youtube.com, 7},
 {img.youtube.com, 7}, {images.ctv.ca, 1}, {www.partivert.ca, 22},
 {www.gca.ca, 2}, {www.communitywalk.com, 2}, {www.flickr.com, 1},
 {vimeo.com, 2}, {www.oee.nrcan.gc.ca, 2}, {naturechallenge.org, 2},
 {e-activist.com, 2}, {www.e-activist.com, 2}, {www.naturechallenge.org, 1},
 {www.youtube.com, 2}, {v18.lscache5.c.youtube.com, 2},
 {xfer.ndp.ca, 1}, {www.cbs.com, 1}, {v2.cache7.c.youtube.com, 1}}
```

```
PieChart[hostfrequency[[All, 2]], ChartLabels → hostfrequency[[All, 1]]]
```



Step Four : Process Content of WARC as Stream, Explore CONTENT

Content is a bit trickier, because there s quite a bit of mess in there. In general, we may want to do work like visualize a Word Cloud, term frequency, TF-IDF, even working with the strings. We can do all that, luckily.

The following command will look similar.

```
SetStreamPosition[wFile, 1];
content = Reap[
   While[(tempRecord = Read[wFile, Record, RecordSeparators → {"WARC/1.0"}]) =!=
     EndOfFile, tempRecordAssociation = recordToAssociation[tempRecord];
    Sow[tempRecordAssociation["CONTENT"]];
   ]];
```

We then need to remove HTML tags, split into words, and then do an assorted bunch of cleaning up. Here it is all together, but as sub commands they are:

Removing HTML tags – note that this might be a good intermediate step to further develop the text analysis side.

```
notags = StringReplace[Flatten[content〚2〛], "<" ~~ Except[">"] .. ~~ ">" → ""];
```

Split into words and flatten:

```
words = Flatten[StringSplit[notags]];
```

Remove all words containing &, /, @, and :

```
cleaned = Select[words, StringFreeQ[#, {___ ~~ "&" ~~ ___, ___ ~~ "/" ~~ ___,
      ___ ~~ "@" ~~ ___, ___ ~~ ":" ~~ ___, ___ ~~ "+" ~~ ___}] &];
```

Remove all one-character words, and put into lowercase:

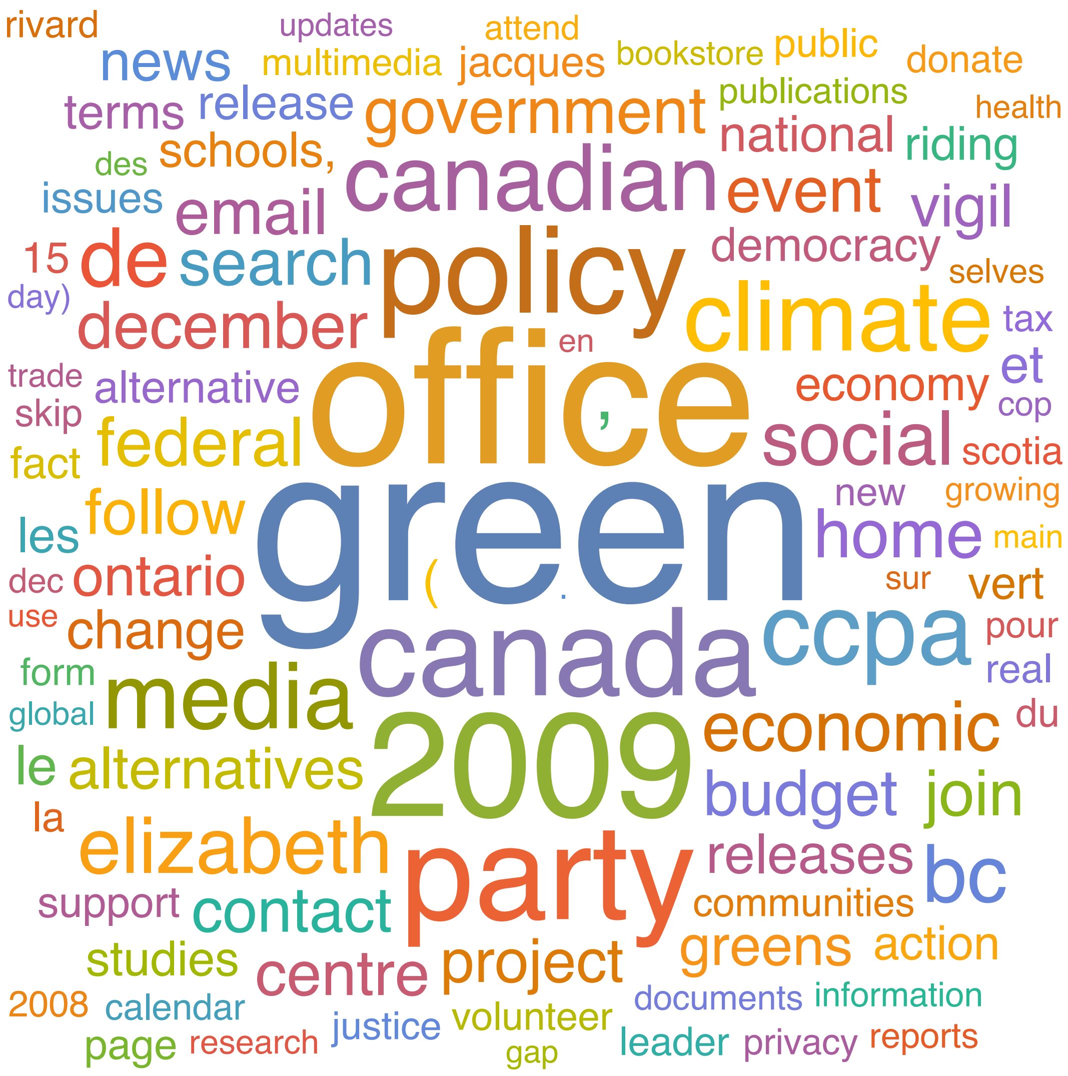
```
lowerclean = ToLowerCase[Select[cleaned, StringLength[#] > 1 &]];
```

But all together is more efficient, as in here:

```
lowerclean = ToLowerCase[Select[Select[Flatten[StringSplit[
       StringReplace[Flatten[content〚2〛], "<" ~~ Except[">"] .. ~~ ">" → ""]]],
     StringFreeQ[#, {___ ~~ "&" ~~ ___, ___ ~~ "/" ~~ ___, ___ ~~ "@" ~~ ___,
        ___ ~~ ":" ~~ ___, ___ ~~ "+" ~~ ___}] &], StringLength[#] > 1 &]];
```

Then we can create a word cloud, by deleting stopwords.

```
WordCloud[DeleteStopwords[lowerclean]]
```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public
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canadian
issues
email
event
vigil
democracy
de
search
policy
selves
day)
december
climate
tax
en
trade
alternative
office
economy
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skip
cop
federal
social
scotia
fact
new
growing
les
follow
green
home
main
(
dec
ontario
sur
vert
use
change
canada
ccpa
pour
form
real
media
global
economic
du
le
alternatives
budget
join
la
elizabeth
releases
bc
party
support
contact
communities
studies
greens
action
centre
project
calendar
documents
information
justice
volunteer
page
research
leader
privacy
reports
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