Insights into Customer Behavior from Clickstream Data

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http://rnowling.github.io/

Who Am I?

- Software Engineer at Red Hat
- Data Science Team, Emerging Technologies
  - Evaluate solutions in open-source Big Data space
  - Ensure software works for Red Hat customers
  - Promote data science internally through consulting projects
- Apache Bigtop PMC

Clickstream Data

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61 million page views

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125,000 registered users

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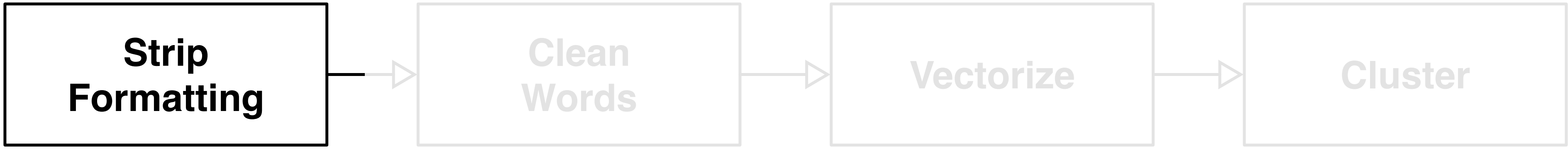
500,000 pages

125,000 knowledgebase articles

Potential Applications

- Build customer profiles to aid sales teams
- Recommendation system for knowledgebase
- Improve customer portal search
- Guide selection of new knowledgebase topics by content writers



Strip Formatting

Clean Words

Vectorize

Cluster

```
What are the different types of kernel packages in Red Hat
Enterprise Linux?
=============================================================
Issue
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Environment
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Red Hat Enterprise Linux

Resolution
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Red Hat Enterprise Linux contains the following kernel
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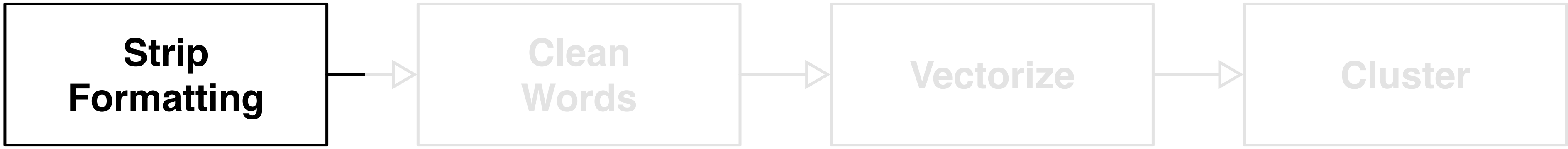

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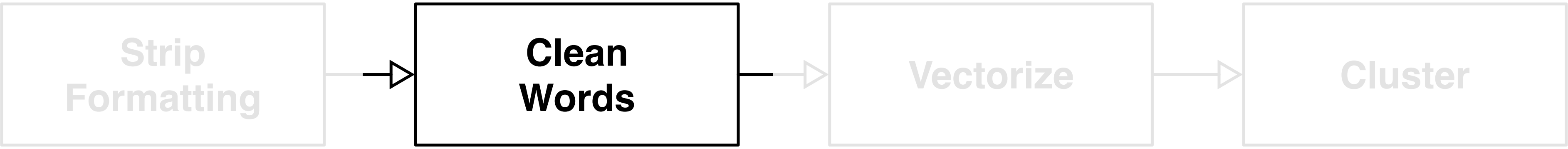
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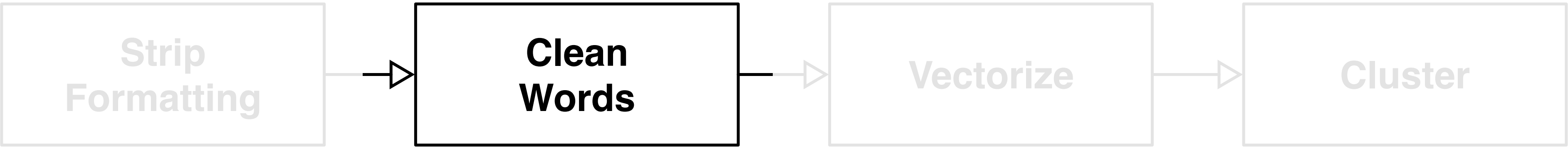

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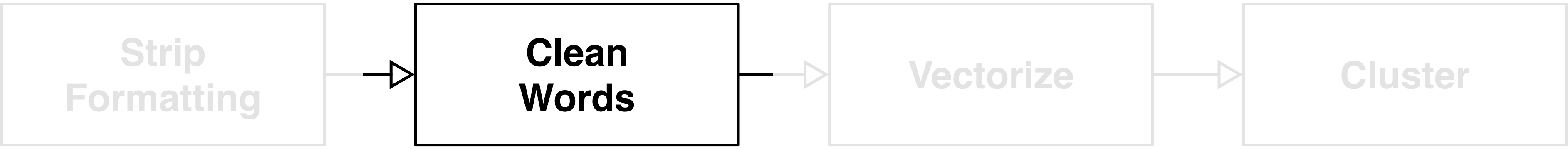

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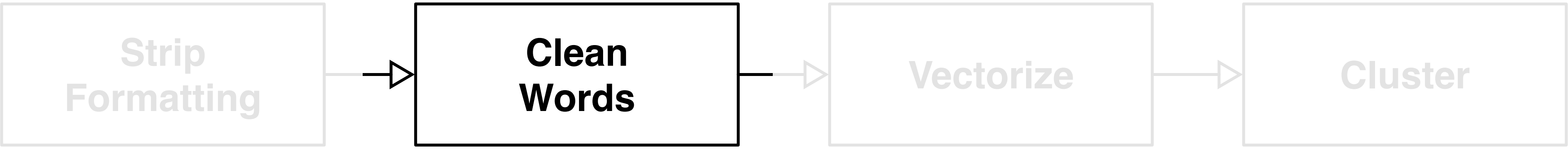
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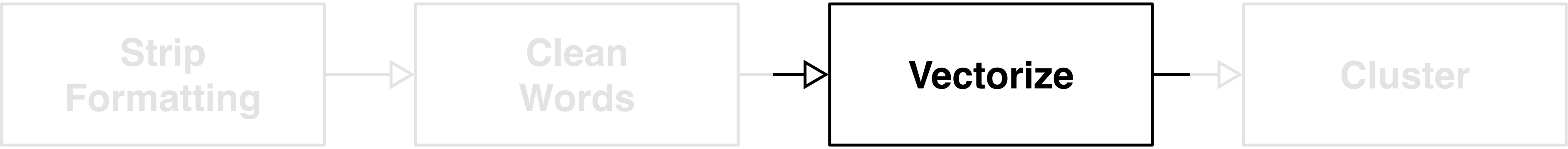

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kernel: 5
red: 4
hat: 4
enterprise: 4
linux: 4
package: 3
contain: 3
different: 2
type: 2
intel: 2
environment: 1
resolution: 1
follow: 1
system: 1
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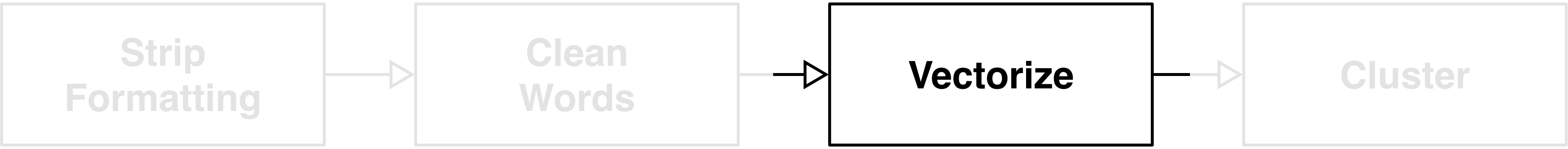

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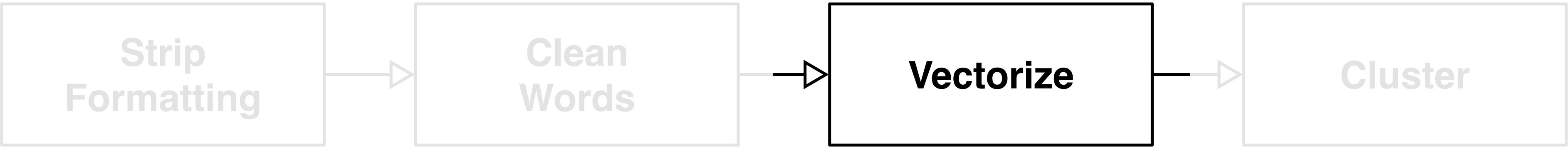

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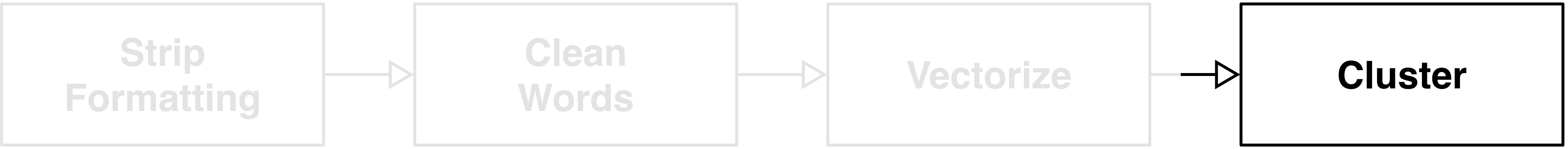

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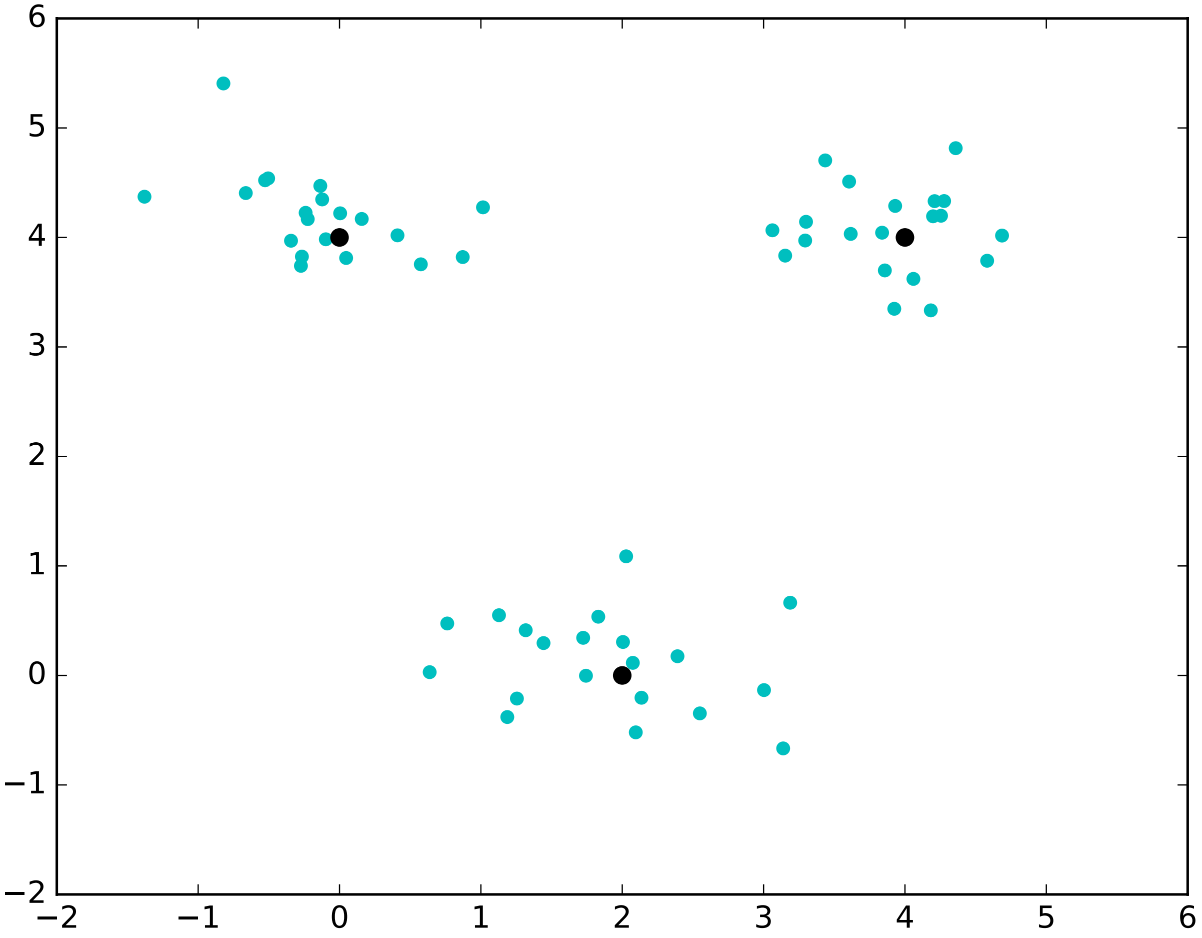

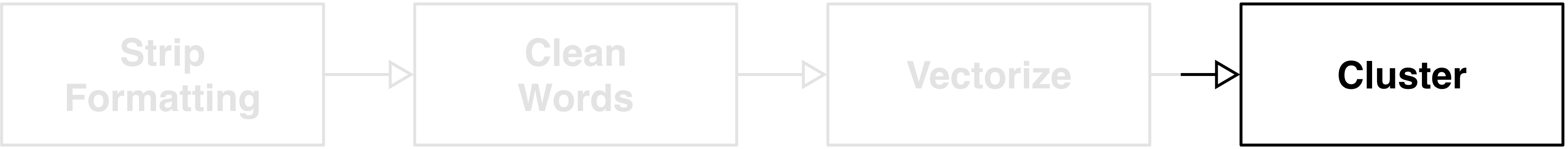
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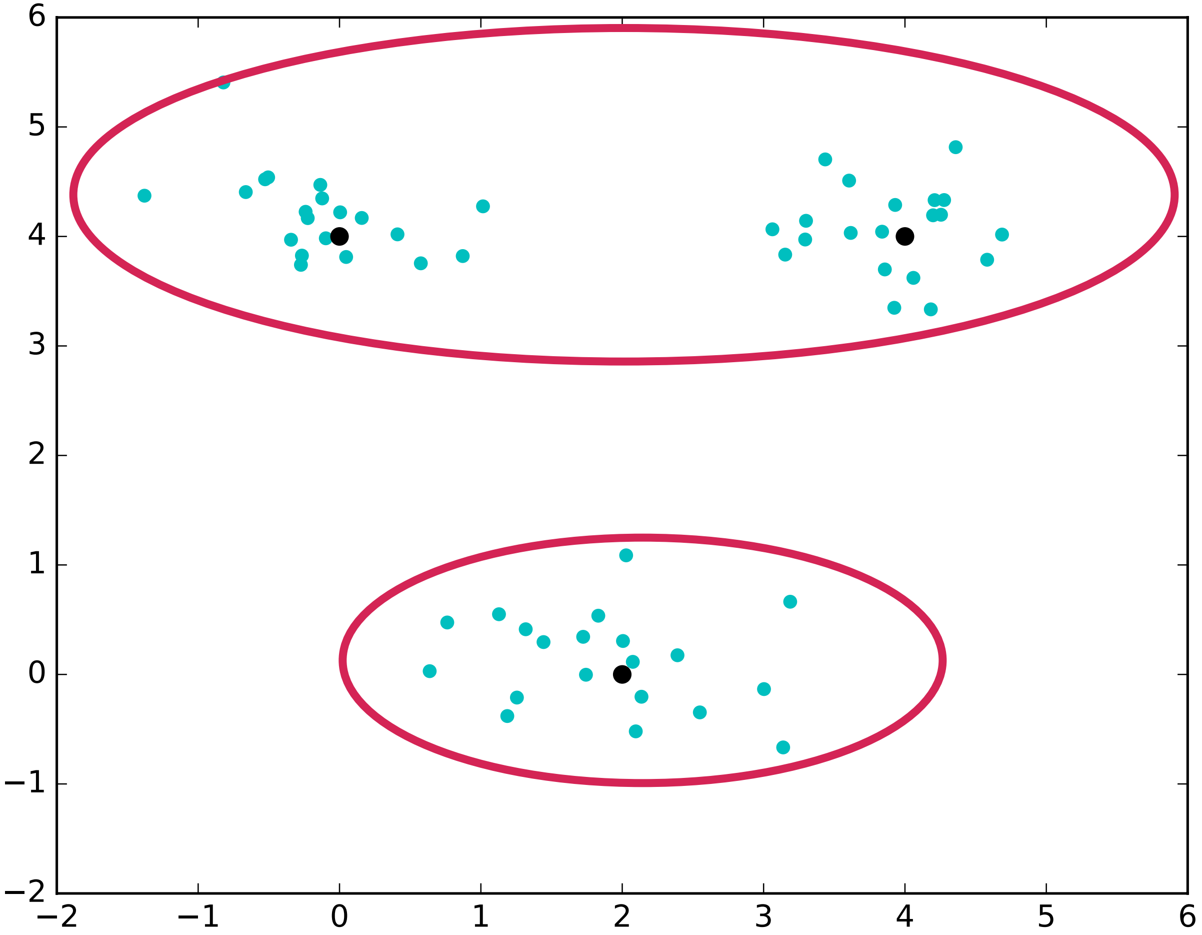
6
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Topics

openshift gear cartridge online
node broker

vm rhev virtualization disk

glusterfs storage volume brick rhs
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rhel support driver hp hardware
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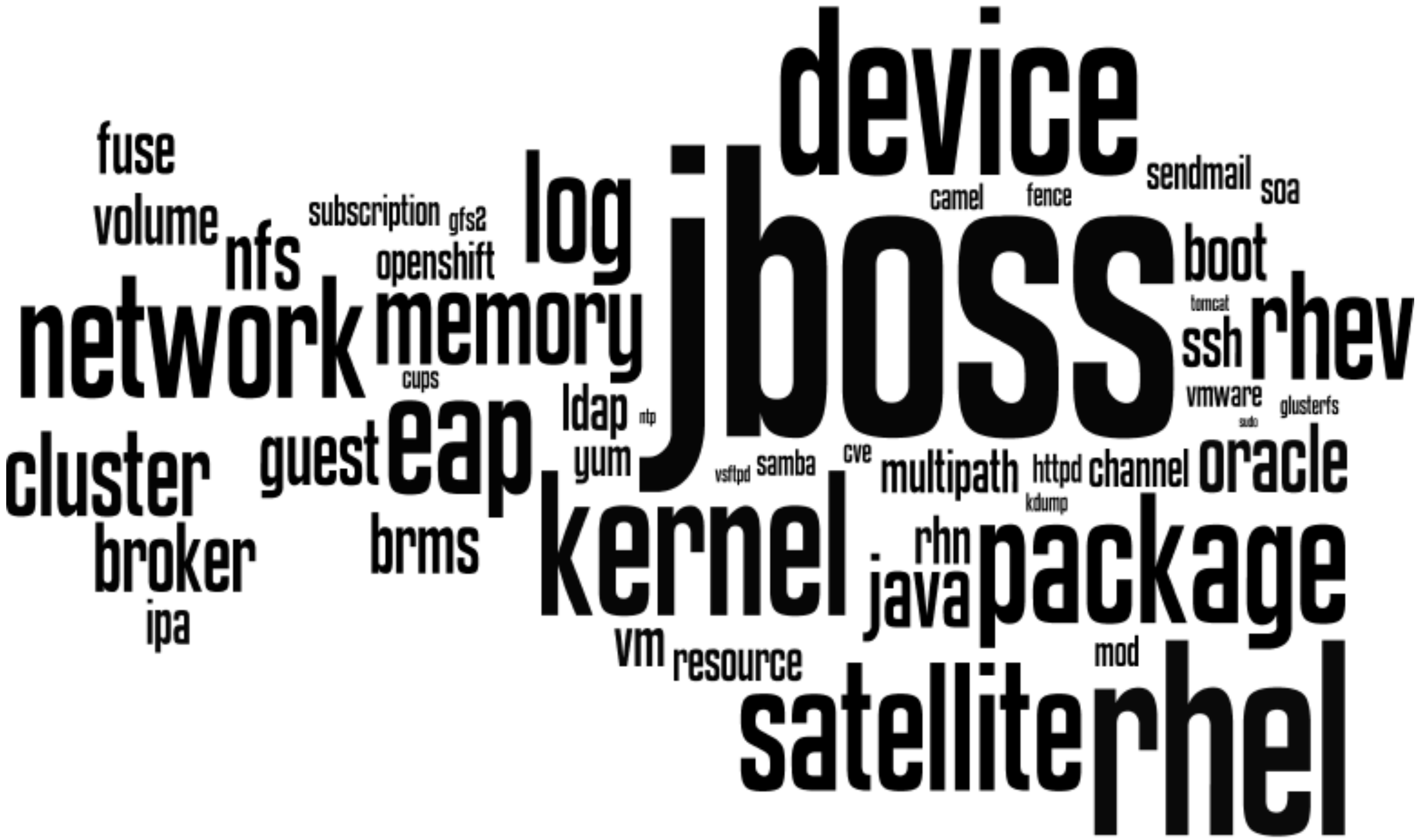
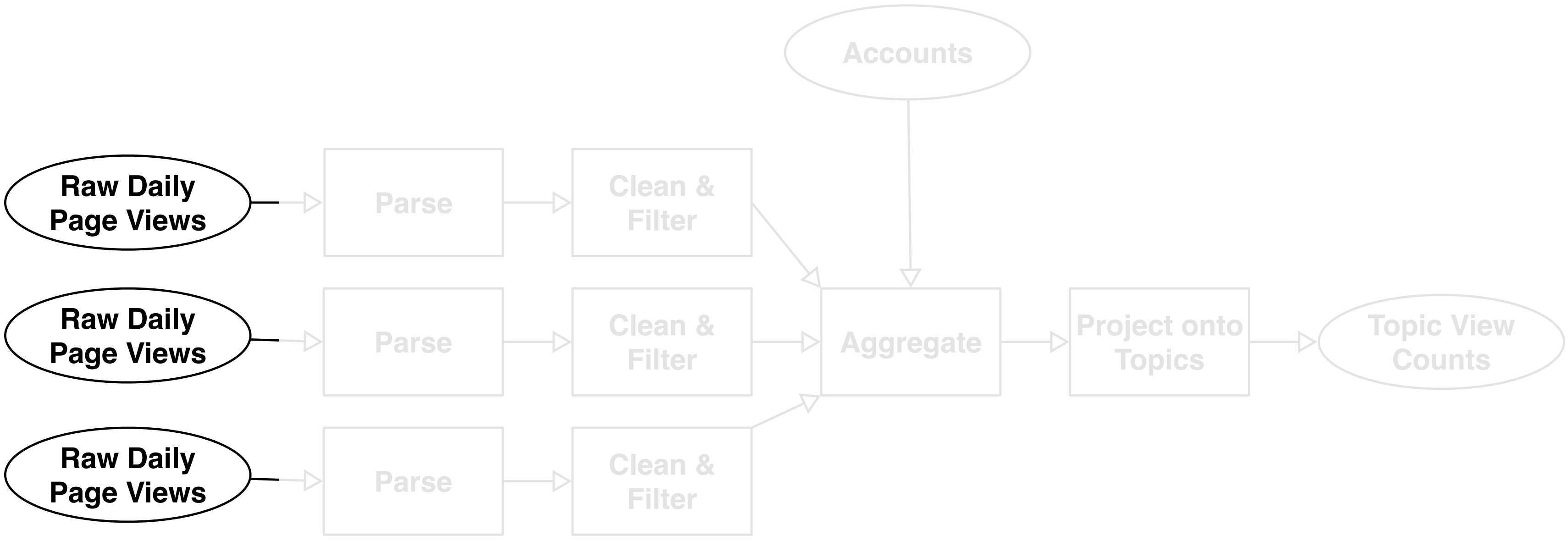
Topic Article Counts



Clickstream Processing



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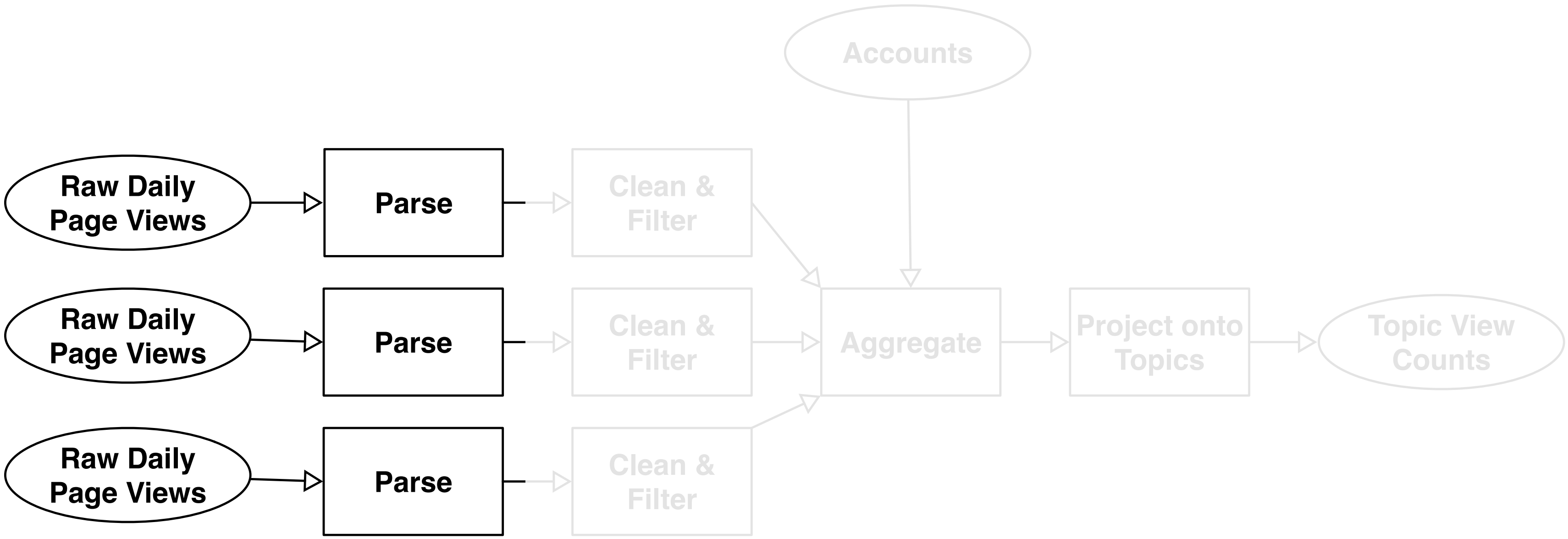

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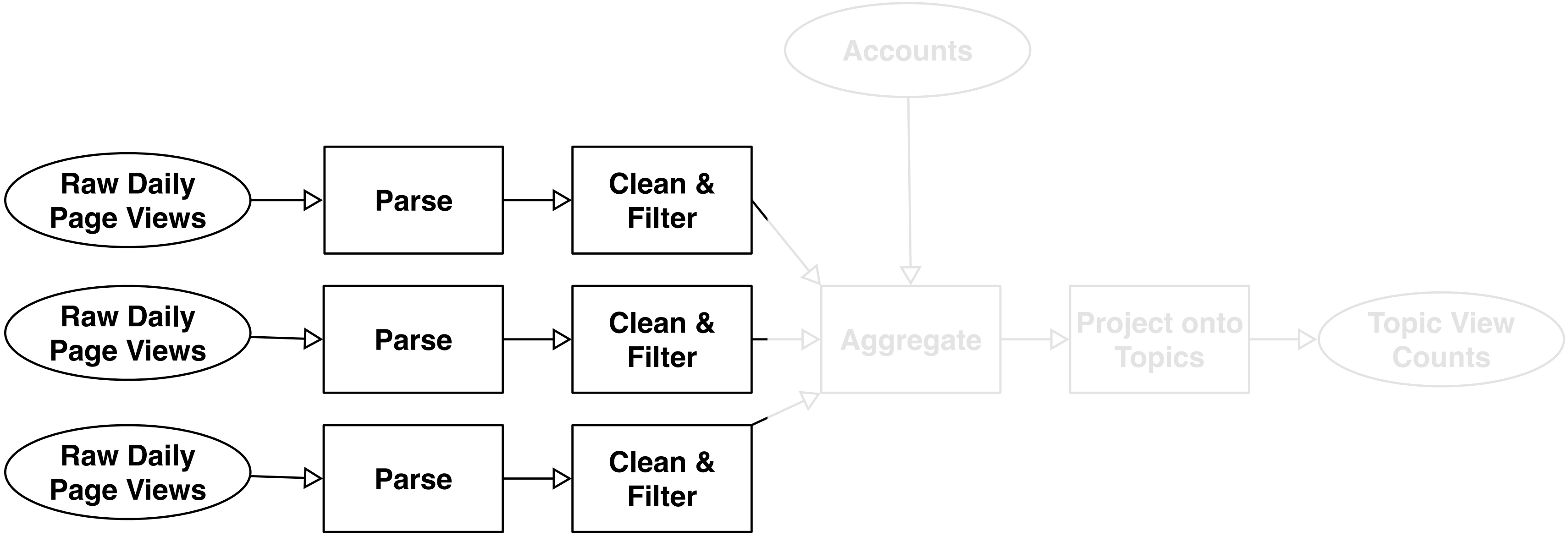

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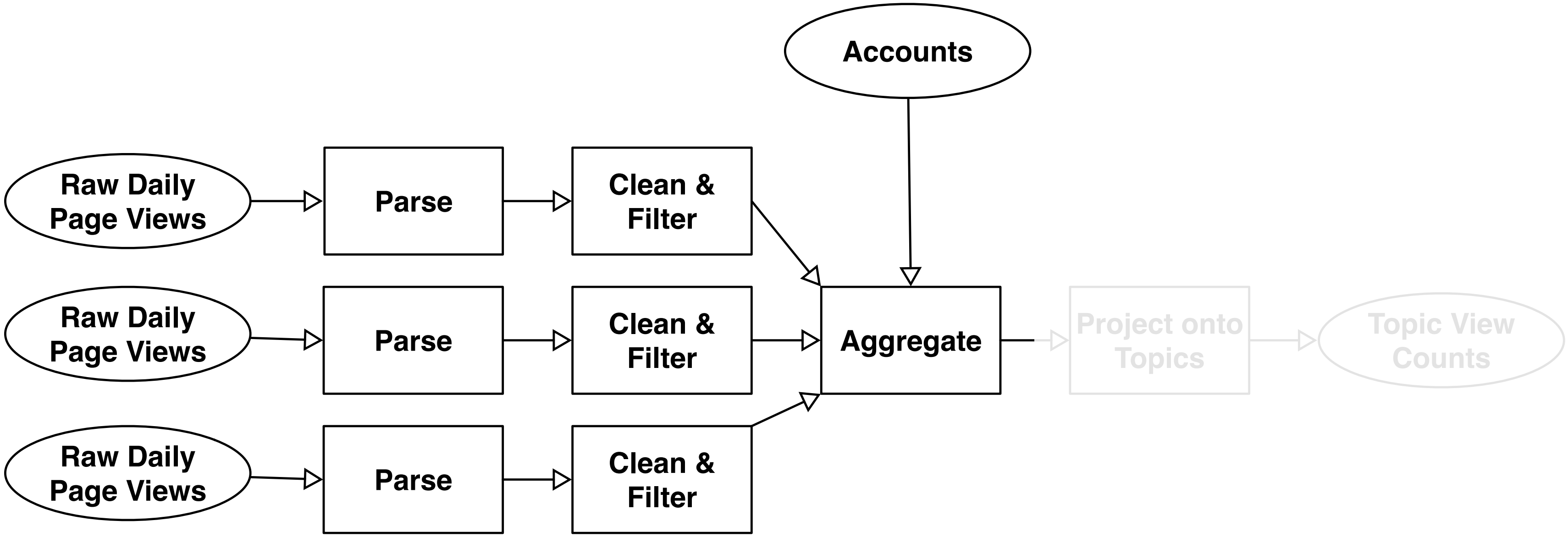

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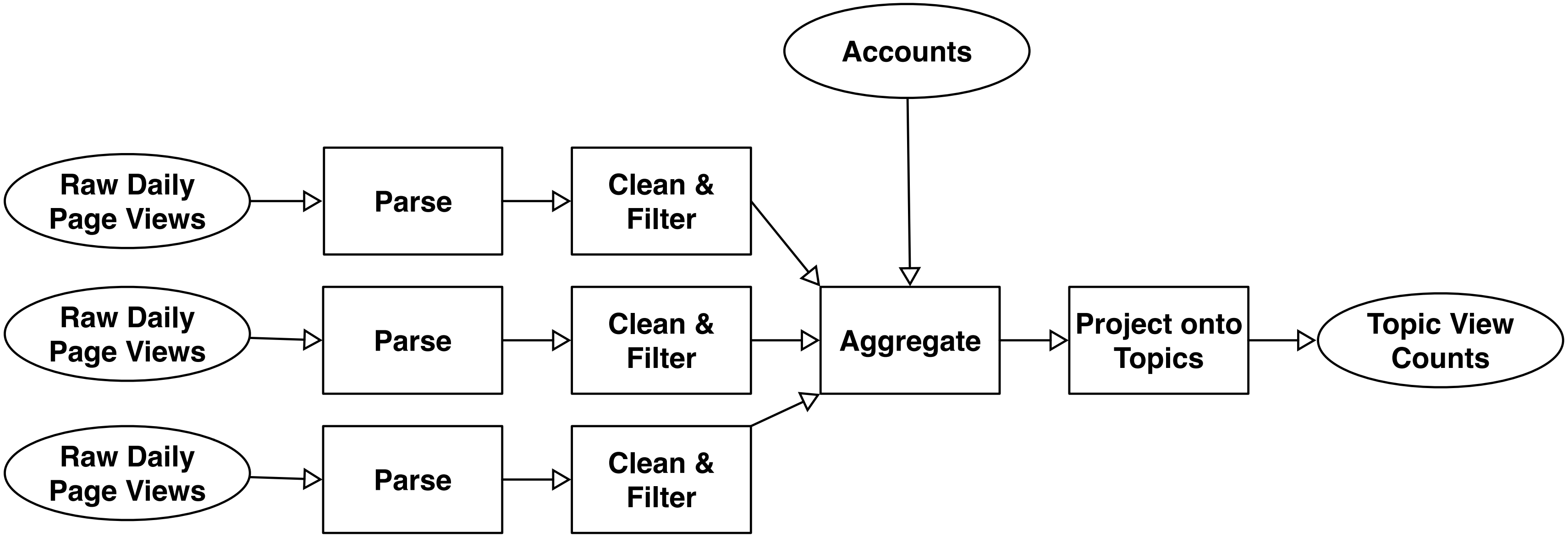


Customer Profiles

- Dominant topics
  - JBoss
  - Red Hat Enterprise Virtualization
  - Hardware support
  - Gluster
  - Booting into rescue mode
  - Packages

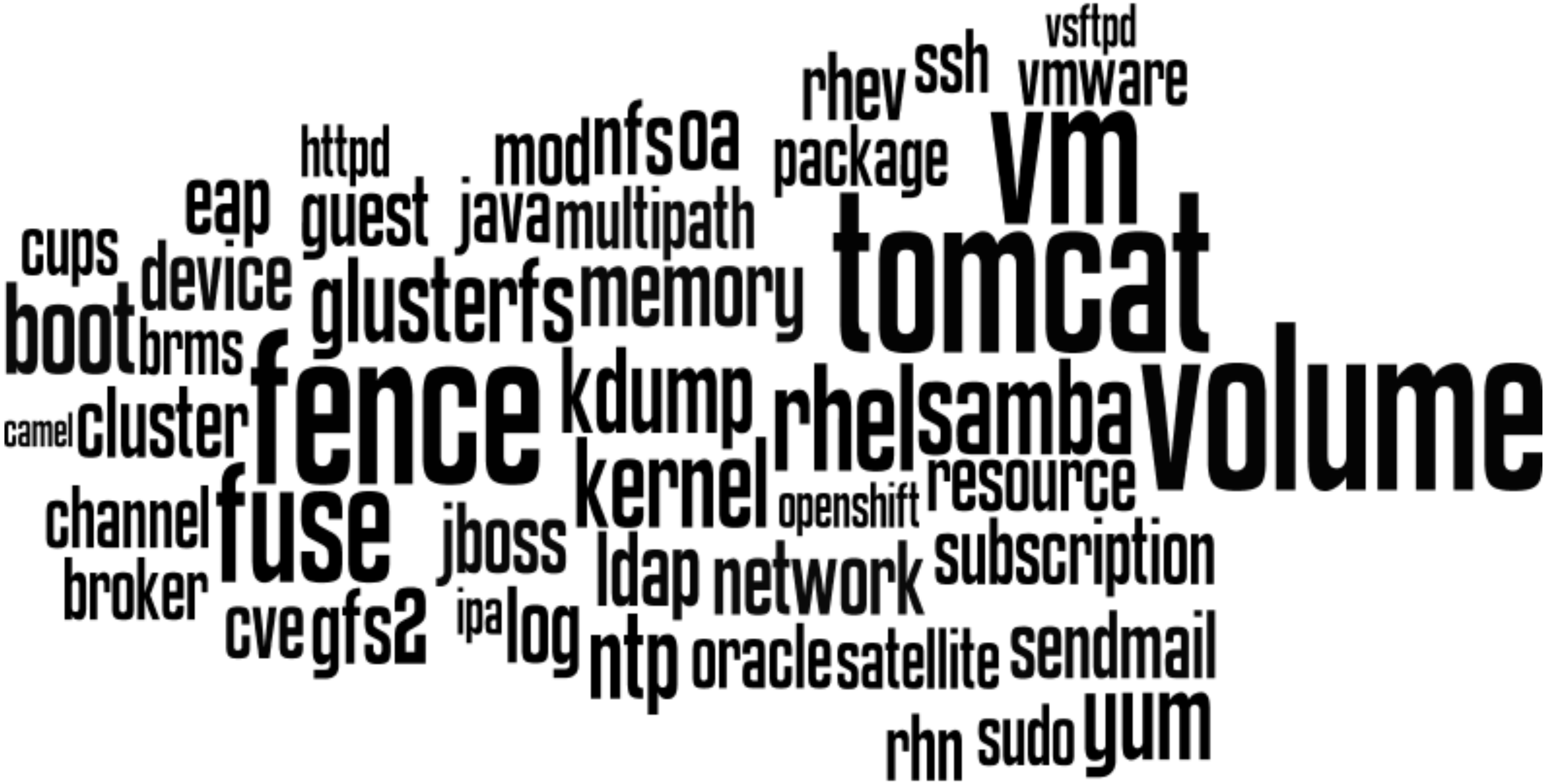
Customer Profiles

- Supporting topics
  - Logging
  - LDAP
  - Samba
  - High resource usage
  - File systems / LVM / block devices
  - Networking

Customer Profiles

- JBoss and RHEV appear in combination with a number of other products
- Some products only appear by themselves with supporting topics (logging, networking, filesystems)
  - OpenShift
  - Gluster

Topic Enrichments



Malformed TSV Files

- Gzip files need to be read sequentially
- Tab-separated, no quoting (in theory!)
- Escaped tabs and newlines within records
  - E.g., `\\n` or `\\t`
- Improperly escaped tabs and newlines
  - E.g., `\\\t` vs `\\\\t`
- Extraneous unmatched quote marks
  - E.g., ‘`some_user`

Lessons Learned

- Consider custom Hadoop input formats for tricky file formats
- Verify everything – what works in general may not work for you
  - Stemming
  - Filtering most frequent words
  - K-Means vs LDA

Lessons Learned

- K-Means
  - Improve accuracy: Multiple runs, more iterations
- Watch out for memory leaks
  - Un-persist cached RDDs
  - Un-persist broadcasted variables
- Parquet for performance

Potential Applications

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- Recommendation system for knowledgebase
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Resources

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QUESTIONS