HATHI TRUST
RESEARCH CENTER

# HathiTrust Research Center: Challenges and Opportunities in Big Text Data

Digital Library Brown Bag | 5.Mar.14

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# HathiTrust Digital Library

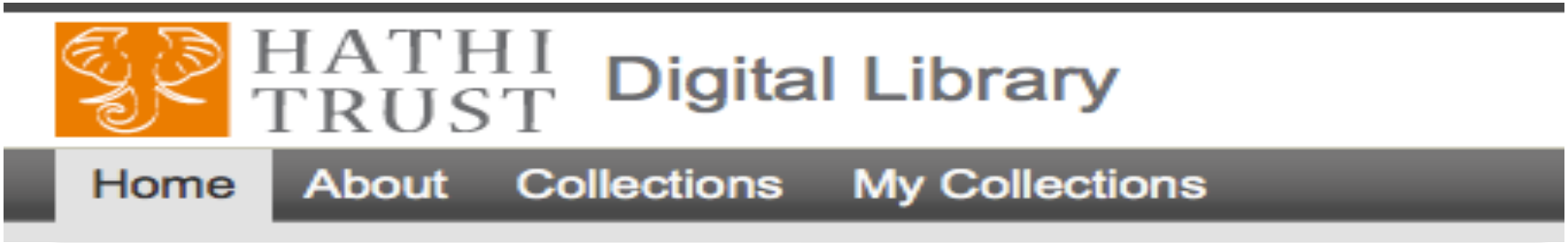
- HathiTrust is a partnership of academic & research institutions, offering a collection of millions of titles digitized from libraries around the world.
  - Founding members of HathiTrust along with University of Michigan are Indiana University, University of California, and University of Virginia

http://www.hathitrust.org

→ Distinguished from

RESEARCH CENTER

http://www.hathitrust.org/htrc




## Currently Digitized (by 2/11/2014)

- 11,014,179 total volumes
- 5,750,943 book titles
- 286,864 serial titles
- 3,854,962,650 pages
- 494 terabytes
- 130 miles
- 8,949 tons
- 3,637,649 volumes(~33% of total) in the public domain

http://www.hathitrust.org/statistics_info

→ HathiTrust repository is a latent goldmine for text mining analysis, analysis of large-scale corpi through computational tools, and time-based analysis

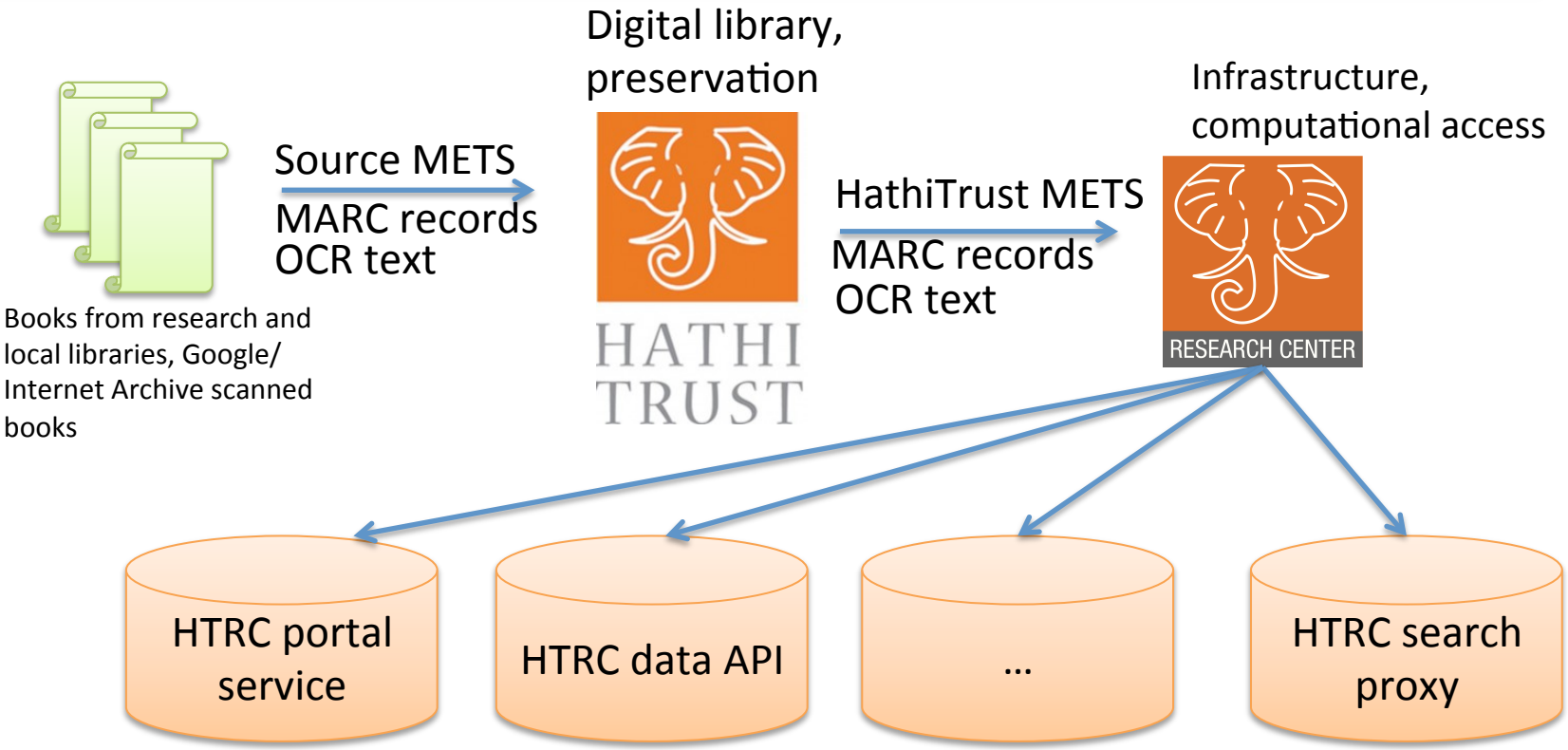
→Restricted nature of HT content suggests need for new forms of access that preserve intimate nature of research investigation while honoring restrictions

→ Paradigm: computation takes place close to the data

# Mission of HT Research Center

- Research arm of HathiTrust
- Goal: enable researchers world-wide to carry out computational investigation of HT repository through
  - Develop model for access: the 'workset'
  - Develop tools that facilitate research by digital humanities and informatics communities
  - Develop secure cyberinfrastructure that allows computational investigation of entire copyrighted and public domain HathiTrust repository
- Established: July, 2011
- Collaborative effort of Indiana University, University of Illinois, and HathiTrust

# Books => HT => HTRC



# Partitioning the HTRC Collections

- Public domain corpus (~3.6M)
  - Non-Google digitized (~250K)
    - Also referred to as the "open-open" corpus
    - On sandbox
  - Google digitized (~2-3M)
    - Production stack
- In-copyright corpus (~7.5M)
  - in progress

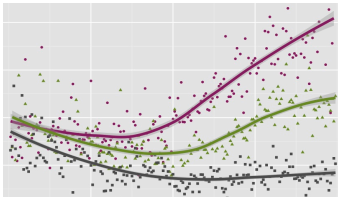
# HTRC

The complexity

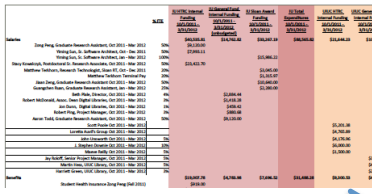
Complexity hiding interface

Request

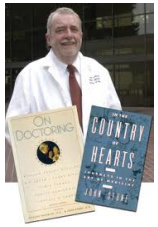

Spatial plots



Statistical plots



Tabular info



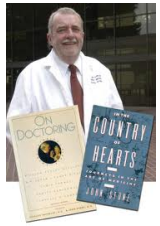
TEXT MINING TOOLS

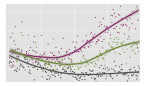
mahout

R

seasr

Complexity hiding interface

HATHI TRUST REPOSITORY

HTRC

@IU @UIUC

EXTRACTED FEATURE SETS

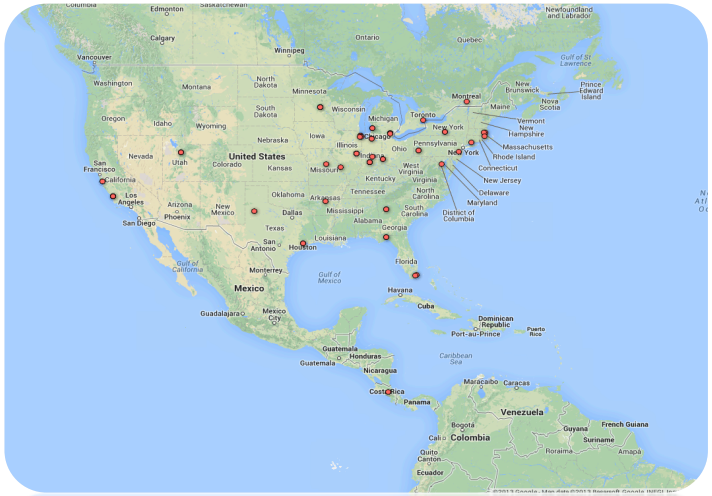
OTHER TEXT, E.G., DICTIONARIES, WIKI, TWITTER


BLUE WATERS

# HTRC Timeline

- Phase I: development 01 Jul 2011 – 31 Mar 2013
  - HTRC software and services release v1.0 http://sourceforge.net/p/htrc/code/
- Phase II: outreach, 01 Apr 2013 - present
  - 2nd HTRC UnCamp Sep '13


Attendees of UnCamp'13

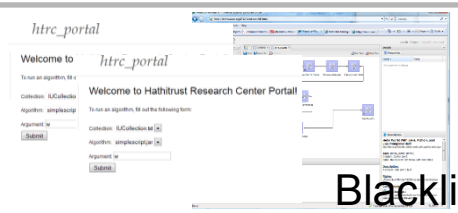


# HTRC architecture


- Philosophy:  computation moves to data
- Web services (REST) architecture and protocols
- WS02 Registry for worksets and results
- Solr Indexes: full text, MARC, and new metadata
- noSQL (Cassandra) store as volume store
- Authentication using WSO2 Identity Server
- Portal front-end, programmatic access
- Mining tools:  currently SEASR

ssh client

Portal




Blacklight

RESEARCH CENTER

Secure Capsule Service

Secure Capsule Instance Manager

User session management

Agent

Agent instance

Agent instance

Sigiri job deployment

mahout

SEASR analytics service

Meandre Orchestration

HTRC Data API v0.1

Registry Services, worksets

WSO2

Solr index

Volume store (Cassandra)

Page/volume tree (file system)

Identity Server

WSO2

rsync

HathiTrust corpus

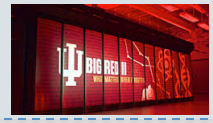
HATHI TRUST

University of Michigan

Secure Capsule Cluster

Hadoop Cluster (MapReduce/ HDFS)

SEASR service execution

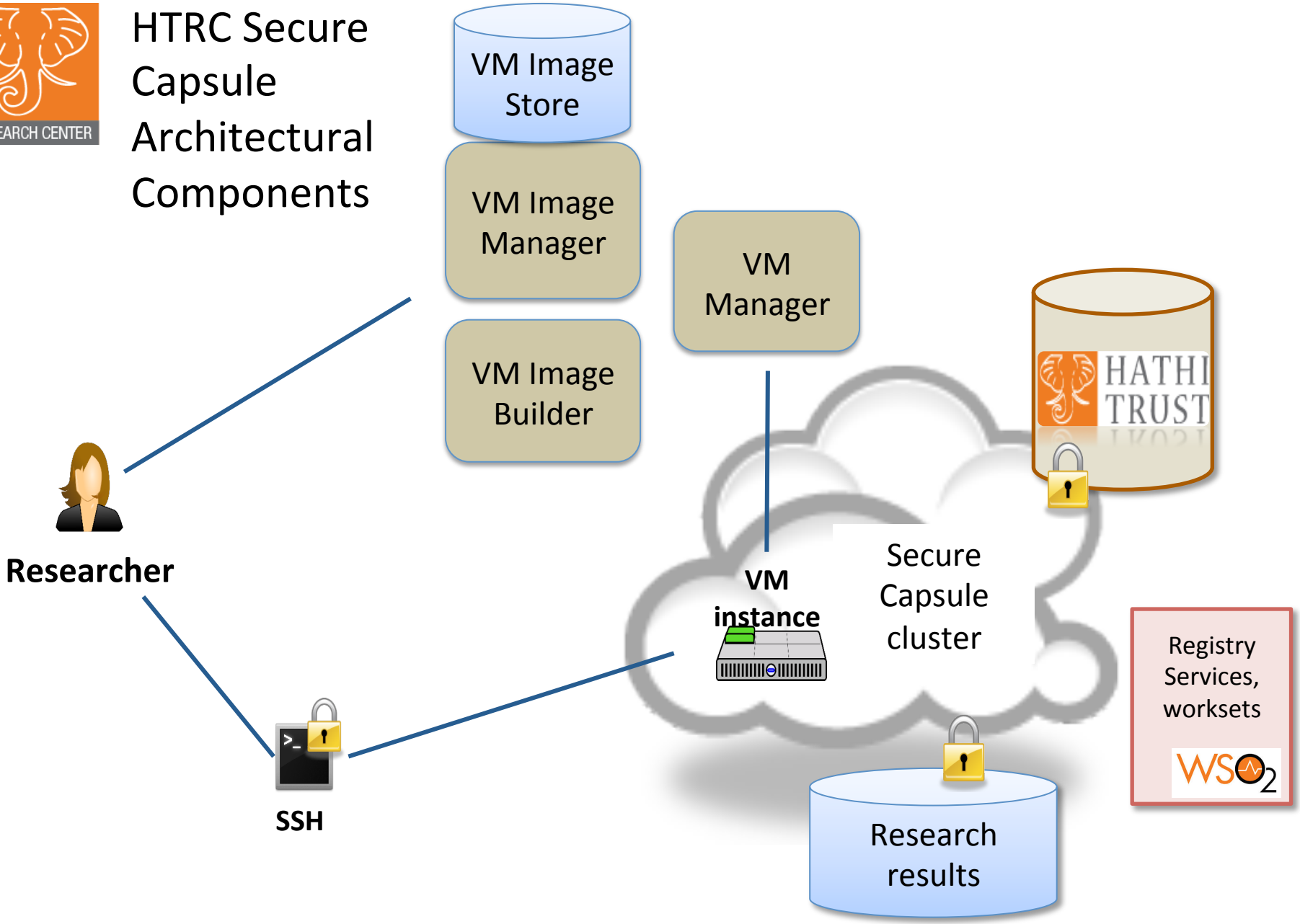


IU compute resources

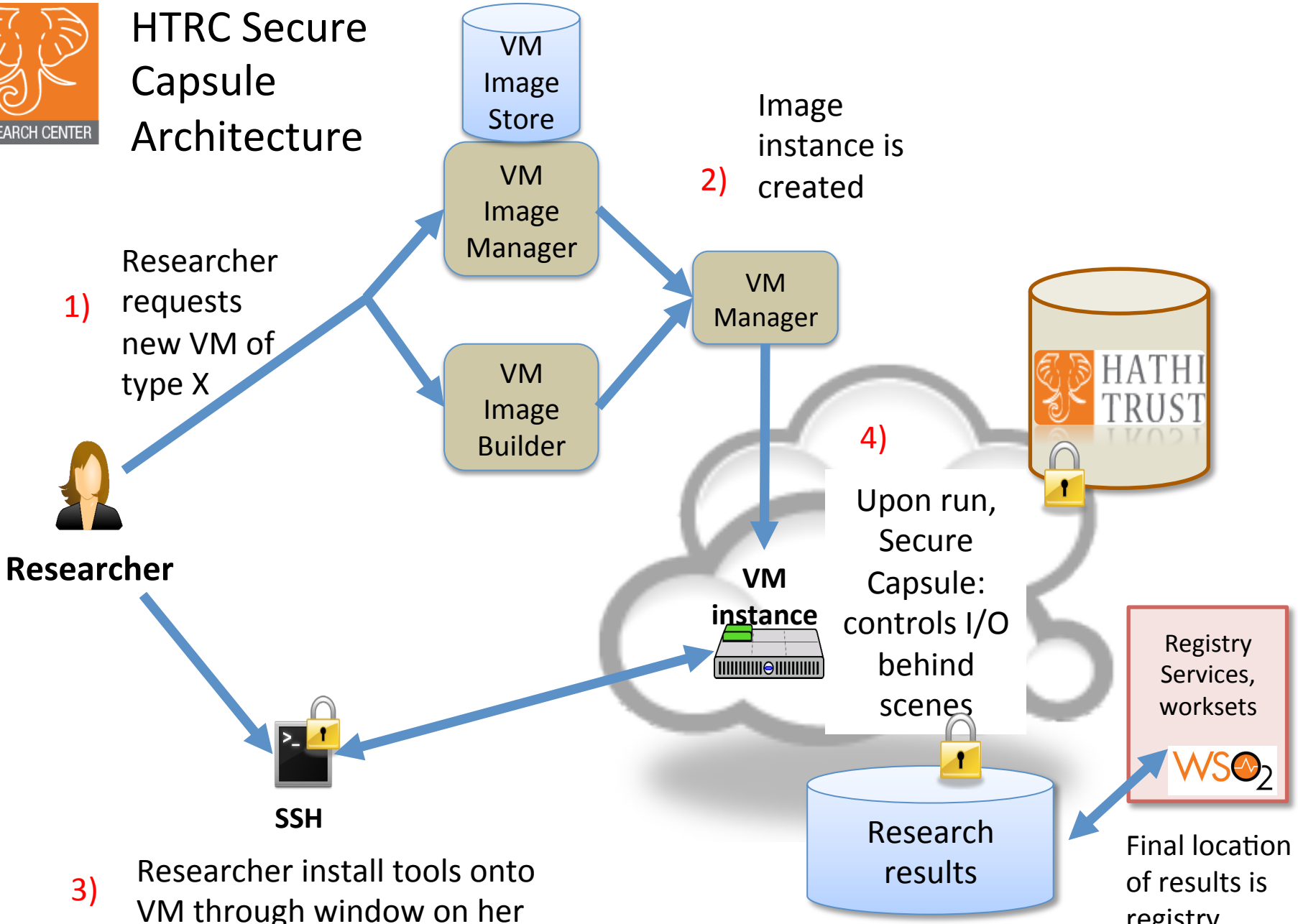
# HTRC's guiding principle to computational access

- *No computational action or set of actions on part of users, either acting alone or in cooperation with other users over duration of one or multiple sessions can result in sufficient information gathered from the HT repository to reassemble pages from collection for reading*
- Definition disallows collusion between users, or accumulation of material over time.
- Defining "sufficient information": research has shown need to interact directly with select texts. How much of a text to show? Google withholds from showing to reader every 10th page of a book (Int'l NYTimes Nov 16-17, 2013)

# HTRC Secure Capsule Architectural Components

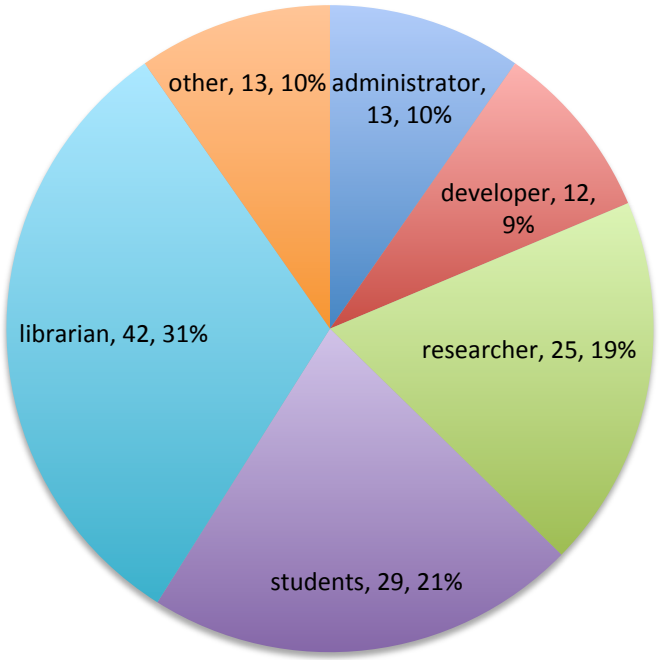


# HTRC Secure Capsule Architecture

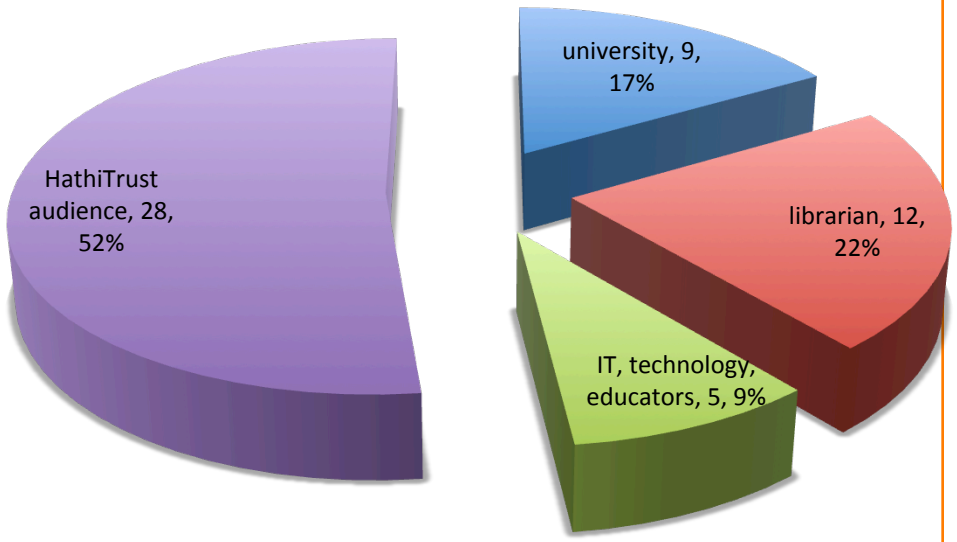


# HTRC and library

- Out of the 134 UnCamp participants, 42 were librarians (31%)




- Target audience of HTRC news (22% to librarians)

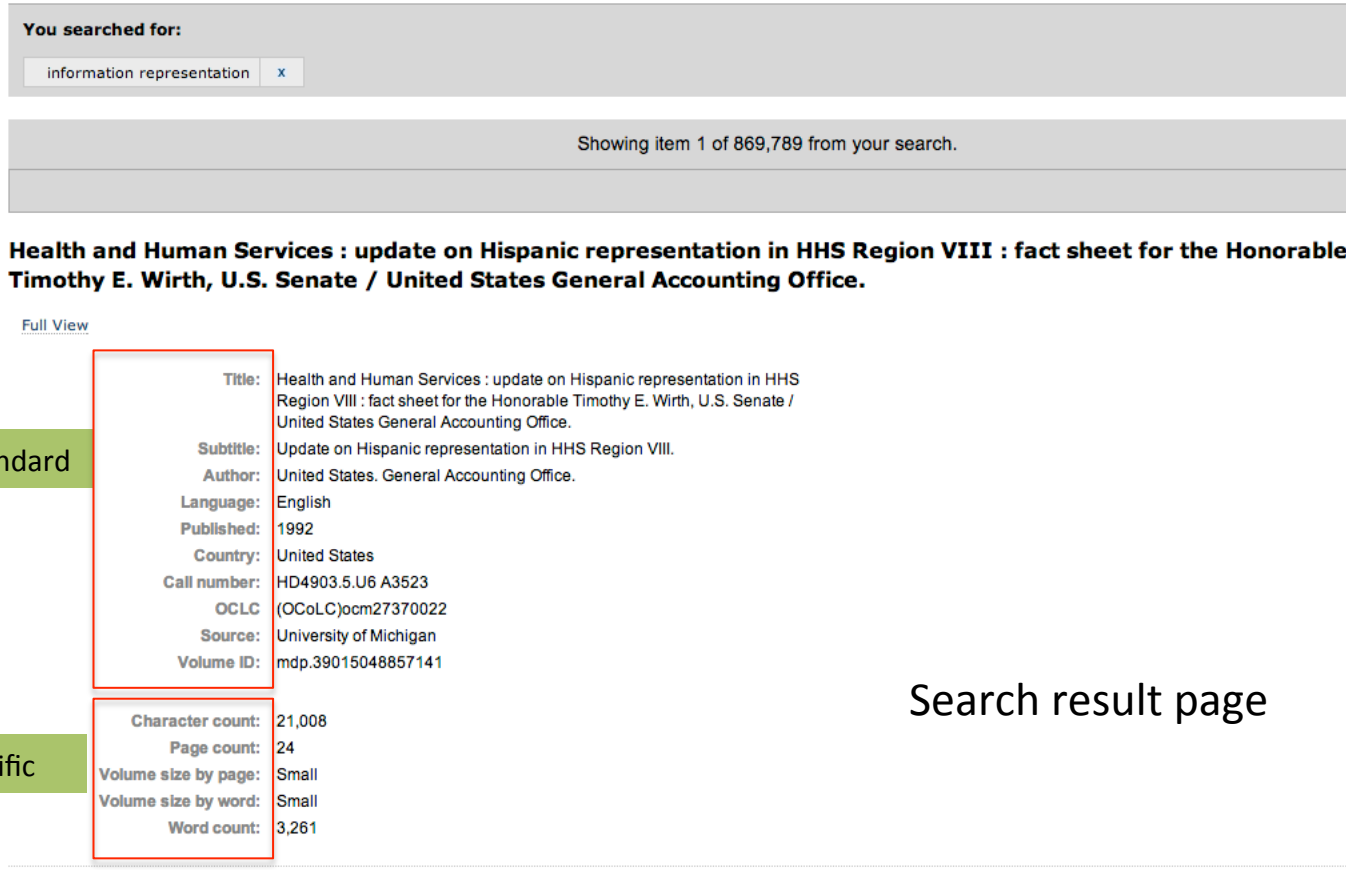



Metadata!

# HTRC metadata

- Volume
  - The central entity for metadata description
  - Books, journal, serials, government docs…
- MARC records (xml uploaded from libraries)
  - Specs: http://www.hathitrust.org/bib_specifications
  - Contains OCLC number (master record number)
- METS(metadata encoding and transmission standard)
  - Source METS files, for preservation (from Google, Internet Archive)
  - HathiTrust METS files, for both preservation and access
- Plus HTRC specific metadata fields

# HTRC metadata



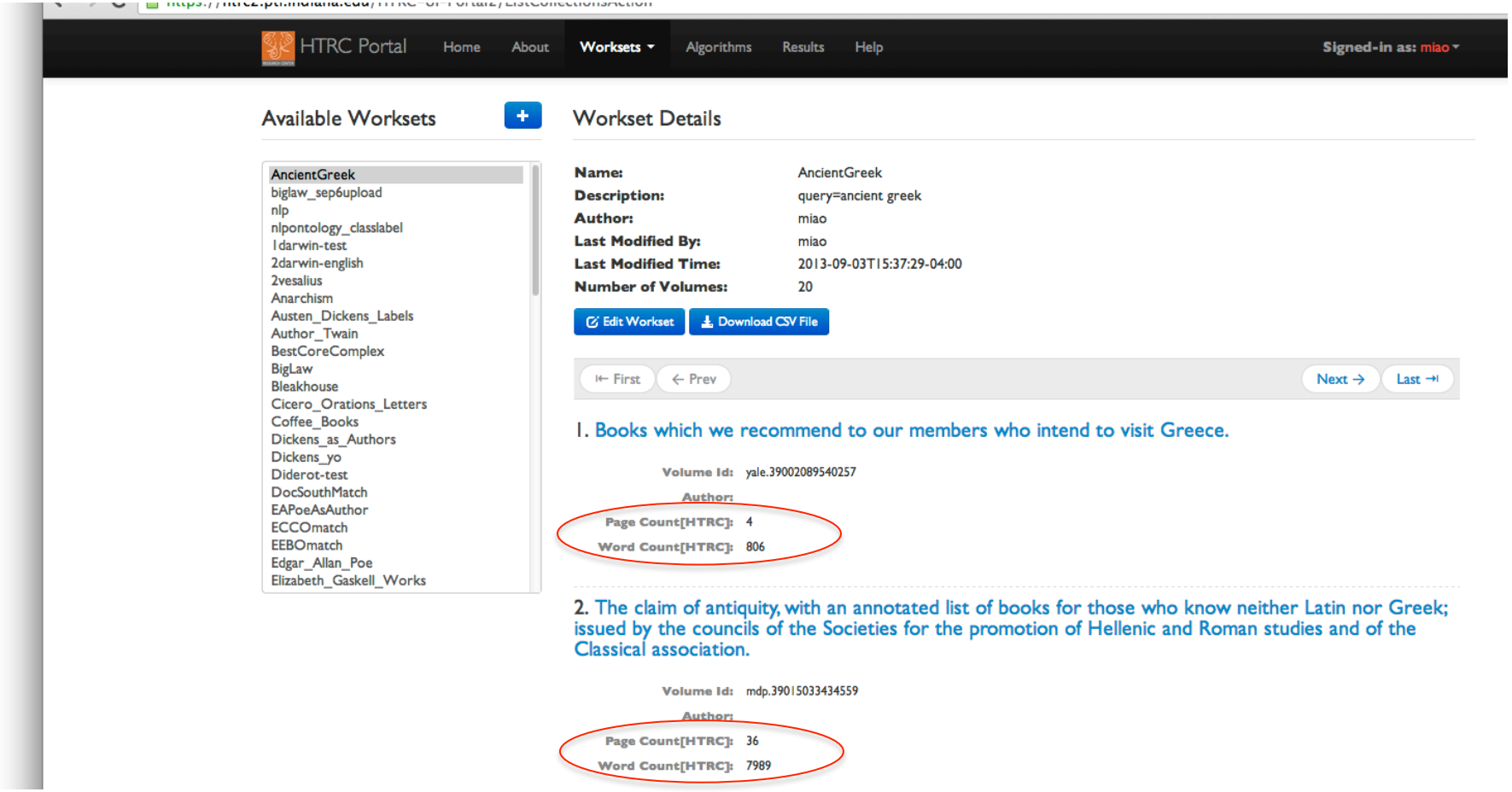

MARC standard

HTRC specific

Search result page

# HTRC specific metadata

Work set display page



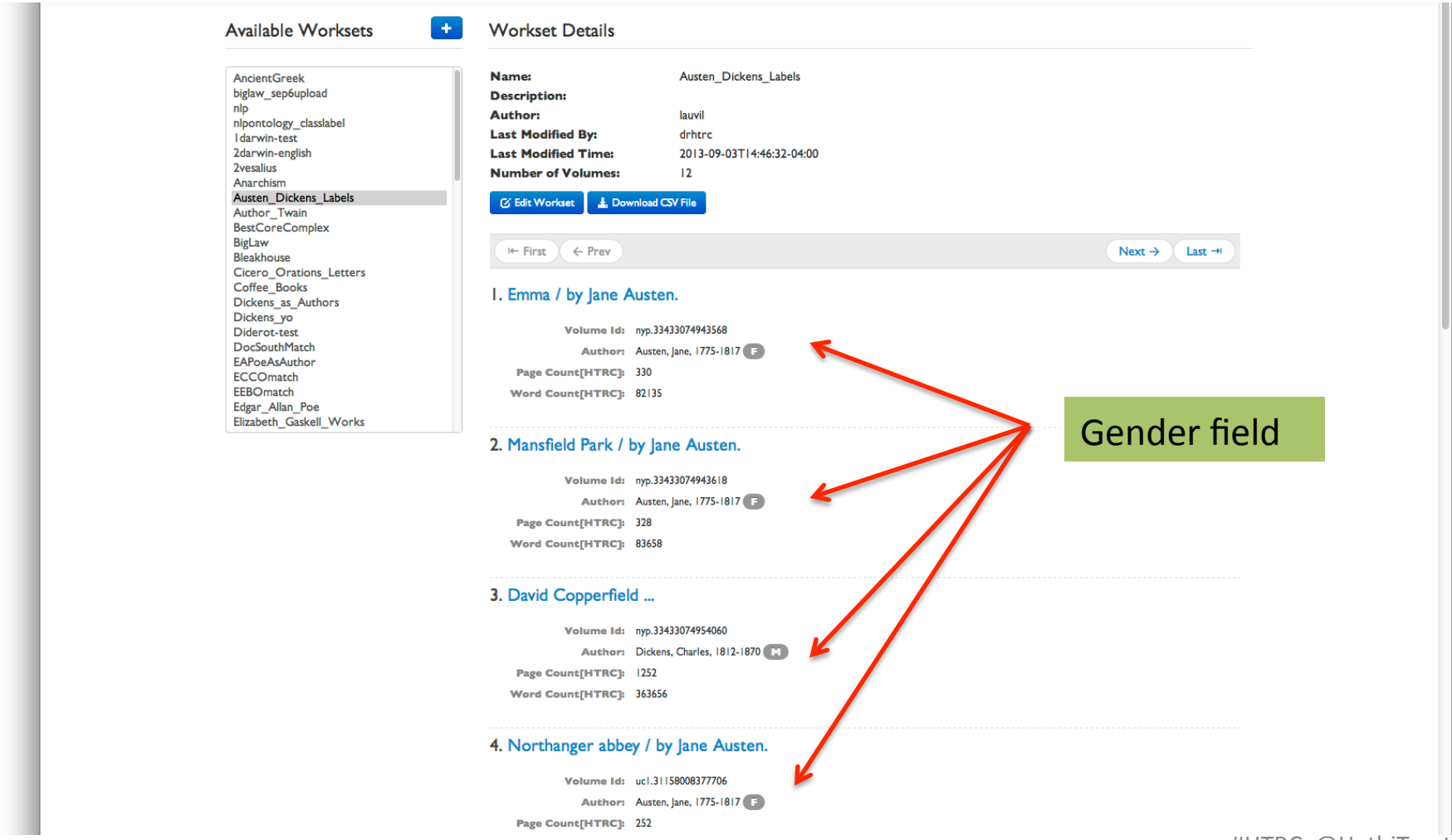
# Metadata Enhancement

- Big data needs good metadata
- Current metadata fields are MARC-based
  - E.g. publication date, authors, title, subject
- MARC fields are fundamental
- Needed more fields of users' interest for granular analytics (Metadata Enhancement)
- Solicit user requirements and prioritize for implementation
  - Mainly digital humanities uses now

# Top Metadata Enhancement Items

- 1st round user requirement collection, top 3 items were metadata related:
  - Word frequency count and document length for a volume
  - Metadata de-duplication
  - Author Gender Analysis
- We have added word count and gender fields to HTRC metadata, and more are being planned and investigated.

# HTRC specific metadata: Gender

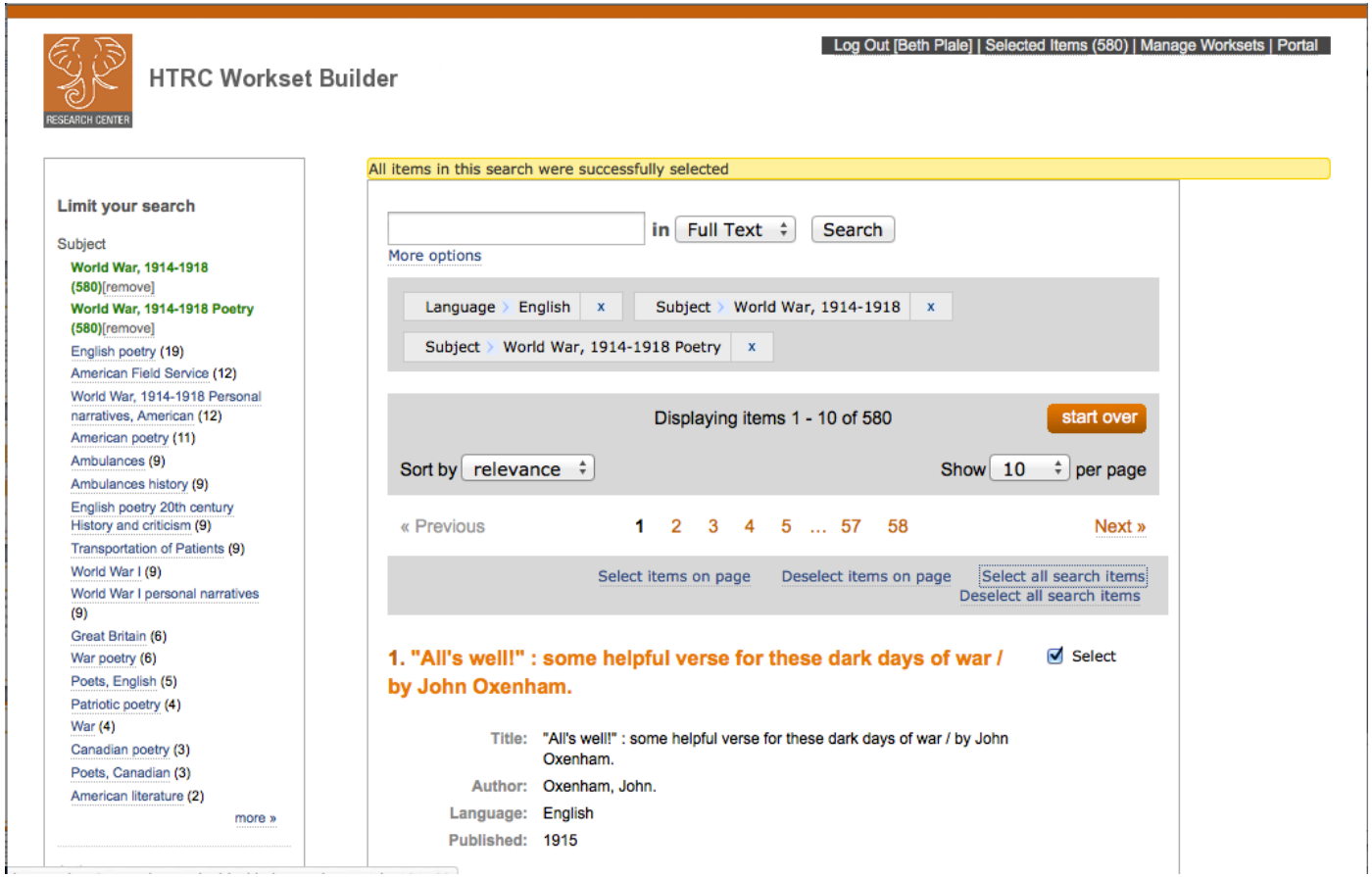


# Other Metadata Enhancement Items

- Stats analysis: tf-idf
- Readability score
- Language
- Topic modeling (e.g. LDA probability)
- Genre
- Era of compilation
- Book length (e.g. short or long)
- Concordance index (indexing with context)

# Portal and Work Set Builder

- https://htrc2.pti.indiana.edu/HTRC-UI-Portal2/



# Data API

- Data retrieval
  - http://wiki.htrc.illinois.edu/display/COM/Python+client+for+accessing+volumes+in+bulk+through+HTRC+Data+API
  - Demo code available in Python and Java
  - Page-level and volume-level word count
  - Option: Concatenate pages
  - Option: return METS metadata, of which MARC record is a part

# Some Challenges

- Internationalization
  - Non-western text, especially for text processing
- Users contributed code
  - How to create a mechanism to describe and archive such contributions from the community?
- OCR errors
  - An experiment shows avg number of errors per page is 0.57
  - Crowdsourcing? Automatic correction?
- Implications
  - HTRC as as a service or resource to library?

# Going beyond the volume level?

- Work set level
  - Should be richer than a list of volume ids
  - The resources that scholars work with
  - Can be within HTRC corpus, or not
  - How to formalize it?
  - What's the metadata for work set?

# Going beyond the volume level?

- Page level
  - Emerges as an important unit of analysis in the recent UnCamp in early Sep
  - Important to scholars in some circumstances
  - What are the important metadata fields?
  - E.g. Word frequency count, image/illustration

# Recent Updates

- "The HTRC drafted documents covering system architecture, workflows, security measures, and data use cases in preparation for offering "non-consumptive" access to in-copyright volumes in the HathiTrust repository. "

Cited from http://www.hathitrust.org/updates_january2014