Apache Tika
What’s new with 2.0?
“small, yellow and leech-like, and probably the oddest thing in the Universe”

- Like a Babel Fish for content!
- Helps you work out what sort of thing your content (1s & 0s) is
- Helps you extract the metadata from it, in a consistent way
- Lets you get a plain text version of your content, eg for full text indexing
- Provides a rich (XHTML) version too
Tika in the news

- Panama Papers – Tika used to extract content from most of the files before indexing in Apache SOLR

- MEMEX – DARPA funded project
  https://nakedsecurity.sophos.com/2015/02/16/memex-darpas-search-engine-for-the-dark-web/
A bit of history
Before Tika

- In the early 2000s, everyone was building a search engine/search system for their CMS/web spider/etc
- Lucene mailing list and wiki had lots of code snippets for using libraries to extract text
- Lots of bugs, people using old versions, people missing out on useful formats, confusion abounded
- Handful of commercial libraries, generally expensive and aimed at large companies and/or computer forensics
- Everyone was re-inventing the wheel, and doing it badly....
Tika's History (in brief)

• The idea from Tika first came from the Apache Nutch project, who wanted to get useful things out of all the content they were spidering and indexing.
• The Apache Lucene project (which Nutch used) were also interested, as lots of people there had the same problems.
• Ideas and discussions started in 2006.
• Project founded in 2007, in the Apache Incubator.
• Initial contributions from Nutch, Lucene and Lius.
Tika Releases
A (brief) introduction to Tika
(Some) Supported Formats

• HTML, XHTML, XML
• Microsoft Office – Word, Excel, PowerPoint, Works, Publisher, Visio – Binary and OOXML formats
• OpenDocument (OpenOffice)
• iWorks – Keynote, Pages, Numbers
• PDF, RTF, Plain Text, CHM Help
• Compression / Archive – Zip, Tar, Ar, 7z, bz2, gz etc
• Atom, RSS, ePub
• Lots of Scientific formats
• Audio – MP3, MP4, Vorbis, Opus, Speex, MIDI, Wav
• Image – JPEG, TIFF, PNG, BMP, GIF, ICO
Detection

- Work out what kind of file something is
- Based on a mixture of things
  - Filename
  - Mime magic (first few hundred bytes)
  - Dedicated code (e.g., containers)
  - Some combination of all of these
- Can be used as a standalone – what is this thing?
- Can be combined with parsers – figure out what this is, then find a parser to work on it
Metadata

• Describes a file
  • eg Title, Author, Creation Date, Location
• Tika provides a way to extract this (where present)
• However, each file format tends to have its own kind of metadata, which can vary a lot
  • eg Author, Creator, Created By, First Author, Creator[0]
• Tika tries to map file format specific metadata onto common, consistent metadata keys
• “Give me the thing that closest represents what Dublin Core defines as Creator”
Plain Text

- Most file formats include at least some text
- For a plain text file, that's everything in it!
- For others, it's only part
- Lots of libraries out there which can extract text, but how you call them varies a lot
- Tika wraps all that up for you, and gives consistency
- Plain Text is ideal for things like Full Text Indexing, eg to feed into SOLR, Lucene or ElasticSearch
XHTML

- Structured Text extraction
- Outputs SAX events for the tags and text of a file
- This is actually the Tika default, Plain Text is implemented by only catching the Text parts of the SAX output
- Isn't supposed to be the “exact representation”
- Aims to give meaningful, semantic but simple output
- Can be used for basic previews
- Can be used to filter, eg ignore header + footer then give remainder as plain text
What's New?
Supported Formats

- HTML
- XML
- Microsoft Office
  - Word
  - PowerPoint
  - Excel (2,3,4,5,97+)
  - Visio
  - Outlook
Supported Formats

- Open Document Format (ODF)
- iWorks
- PDF
- ePUB
- RTF
- Tar, RAR, AR, CPIO, Zip, 7Zip, Gzip, BZip2, XZ and Pack200
- Plain Text
- RSS and Atom
Supported Formats

- IPTC ANPA Newswire
- CHM Help
- Wav, MIDI
- MP3, MP4 Audio
- Ogg Vorbis, Speex, FLAC, Opus, Theora
- PNG, JPG, BMP, TIFF, BPG, ICNS, PSD, WebP
- FLV, MP4 Video – Metadata and video histograms
- Java classes
Supported Formats

- Source Code
- Mbox, RFC822, Outlook PST, Outlook MSG, TNEF
- DWG CAD
- DIF, GDAL, ISO-19139, Grib, HDF, ISA-Tab, NetCDF, Matlab
- Executables (Windows, Linux, Mac)
- Pkcs7
- SQLite
- Microsoft Access
What if you don't have a text file, but instead a photo of some text? Or a scan of some text?
OCR (Optical Character Recognition) to the rescue!

- Tesseract is an Open Source OCR tool
- Tika has a parser which can use Tesseract for found images
- Tesseract is detected, and used if found on your path
- Explicit path can be given, or can be disabled
- TODO: Better combining of OCR + normal, or eg PDF only
Container Formats
Databases
Databases

• A surprising number of Database and “database” systems have a single-file mode
• If there's a single file, and a suitable library or program, then Tika can get the data out!
• Main ones so far are MS Access & SQLite
• Panama Papers dump may inspire some more!

• How best to represent the contents in XHTML?
• One HTML table per Database Table best we have, so far...
Tika Config XML
Tika Config XML

- Using Config, you can specify what Parsers, Detectors, Translator, Service Loader and Mime Types to use
- You can do it explicitly
- You can do it implicitly (with defaults)
- You can do “default except”

- Tools available to dump out a running config as XML
- Use the Tika App to see what you have + save it
Tika Config XML example

```xml
<?xml version="1.0" encoding="UTF-8"?>
<properties>
  <parsers>
    <parser class="org.apache.tika.parser.DefaultParser">
      <mime-exclude>image/jpeg</mime-exclude>
      <mime-exclude>application/pdf</mime-exclude>
    </parser>
    <parser class="org.apache.tika.parser.EmptyParser">
      <mime>application/pdf</mime>
    </parser>
  </parsers>
</properties>
```
Embedded Resources
Tika App
Tika Server
Tika Batch
Named Entity Recognition
Geo Entity Lookup
Augmenting “This was written in Vancouver BC in May” with details of where that is (lat, long, country etc)

- Apache Lucene Gazetter provides fast lookup of place names to geographic details
- Geonames.org dataset used to feed Gazetter
- Apache OpenNLP identifies places in text to lookup
- Needs custom NLP model for place name identification
- GeoTopicParser saves results as metadata, best & alternate
Apache cTAKES
Translation
Language Detection
Troubleshooting

- Finally, we have a troubleshooting guide!
  
  http://wiki.apache.org/tika/Troubleshooting%20Tika

- Covers most of the major queries
- Why wasn’t the right parser used
- Why didn’t detection work
- What parsers do I really have etc!
Tika 1.11

- Library upgrades for bug fixes (POI, PDFBox etc)
- Tika Config XML enhancements
- Tika Config XML output / dumping
- Apache Commons IO used more widely
- Java 7 nio.Path as an alternative to File
- GROBID – GeneRation Of Bibliographic Data – Support for decorating parsing with machine-learnt bibliographic information of scholarly documents
Tika 1.12

- More consistent and better HTML between PPT and PPTX
- NamedEntity Parser, using both OpenNLP and Stanford NER, outputting text and metadata
- GeoTopic Parser speedup via using new Lucene Geo GazetteRest server
- Pooled Time Series parser for video - motion properties from videos to text to allow comparisons
- Bug fixes
Tika 1.13

- Lots of library upgrades – Apache POI, Apache PDFBox 2.0, Apache SIS and half a dozen others!
- Lots of new mimetypes and magic patterns, especially for scientific-related formats
- NamedEntity Parser add support for Python NLTK and MIT-NLP (MITRE)
- Tika Config XML dumping moved to core, and the app can now dump your running config for you
- Bug fixes
- Being voted on right now!
Tika 1.14+

- Commons IO in Core? TBD
- PDFBox 2.0 further updates, along with a 1.8 fallback
- Language Detector improvements – N-Gram, Optimaize Lang Detector, MIT Text.jl, pluggable and pickable
- More NLP enhancement / augmentation
- Metadata aliasing

- Plus preparations for Tika 2
Tika 2.0
Why no Tika v2 yet?

- Apache Tika 0.1 – December 2007
- Apache Tika 1.0 – November 2011
- Shouldn't we have had a v2 by now?
- Discussions started several years ago, on the list
- Plans for what we need on the wiki for ~1 year
- Largely though, every time someone came up with a breaking feature for 2.0, a compatible way to do it was found!
Deprecated Parts

• Various parts of Tika have been deprecated over the years
• All of those will go!

• Main ones that might bite you:
  • Parser parse with no ParseContext
  • Old style Metadata keys
• Currently, Metadata in Tika is String Key/Value Lists
• Many Metadata types have Properties, which provide typing, conversions, sanity checks etc
• But all still stored as String Key + Value(s)

• Some people think we need a richer storage model
• Others want to keep it simple!
• JSON, XML DOM, XMP being debated
• Richer string keys also proposed
Metadata for Video etc

- Video file might have 2 video streams, 4 audio streams, a metadata stream and some subtitles
- Some of those you want to treat as embedded resources
- Some of those “belong” together

- How should we return the number of channels for the 1st audio stream in a video?
- Should it change if there’s one or many?
**Java Packaging of Tika**

- Maven Packages of Tika are
  - Tika Core
  - Tika Parsers
  - Tika Bundle
  - Tika XMP
  - Tika Java 7
- For just some parsers, in Tika 1.x, you need to exclude maven dependencies + re-test
- In Tika 2, more fine-grained parser collections
Tika 2.x Parser Sets

- Available today in Git on the 2.x branch

- Advanced CAD Code
- Crypto Database eBook
- Journal Multimedia Office
- Package PDF Scientific
- Text Web XMP-Commons

- May change some more, but broadly in place now
Fallback/Preference Parsers

- If we have several parsers that can handle a format
- Preferences?
- If one fails, how about trying others?
Multiple Parsers

- If we have several parsers that can handle a format
- What about running all of them?
  - eg extract image metadata
  - then OCR it
  - then try the regular image parser for more metadata
- Or maybe for calling multiple different NER parsers
Currently, Tika uses a Service Loader mechanism to find and load available Parsers (and Detectors+Translators). This allows you to drop a new Tika parser jar onto the classpath, and have it automatically used. Also allows you to miss one or two jars out, and not get any content back with no warnings / errors. You can set the Service Loader to Warn, or even Error. But most people don't, and it bites them! Change the default in 2? Or change entirely how we do it?
What we still need help with...
Content Handler Reset/Add

- Tika uses the SAX Content Handler interface for supplying plain text along with semantically meaningful XHTML
- Streaming, write once

- How does that work with multiple parsers?
  - How about if one parser fails and we want to try parsing with a different one?
  - How about if one parser works, then you want to run a second?
- Language Detection / NER – how to mark up previous text?
Content Enhancement

• How can we post-process the content to “enhance” it in various ways?
• For example, how can we mark up parts of speech?
• Pull out information into the Metadata?
• Translate it, retaining the original positions?
• For just some formats, or for all?
• For just some documents in some formats?
• While still keeping the Streaming SAX-like contract?
Metadata Standards

- Currently, Tika works hard to map file-format-specific metadata onto general metadata standards.
- Means you don't have to know each standard in depth, can just say “give me the closest to dc:subject you have, no matter what file format or library it comes from”.

- What about non-File-format metadata, such as content metadata (Table of Contents, Author information etc)?
- What about combining things?
Richer Metadata

- See Metadata Storage slides!
Bonus! Apache Tika at Scale
Lots of Data is Junk

- At scale, you're going to hit lots of edge cases
- At scale, you're going to come across lots of junk or corrupted documents
- 1% of a lot is still a lot...
- 1% of the internet is a huge amount!
- Bound to find files which are unusual or corrupted enough to be mis-identified
- You need to plan for failures!
If you're working on a big data scale, you're bound to come across lots of valid but unusual + unknown files.

You're never going to be able to add support for all of them!

May be worth adding support for the more common “uncommon” unsupported types.

Which means you'll need to track something about the files you couldn't understand.

If Tika knows the mimetype but has no parser, just log the mimetype.

If mimetype unknown, maybe log first few bytes.
Failure at Scale

- Tika will sometimes mis-identify something, so sometimes the wrong parser will run and object
- Some files will cause parsers or their underlying libraries to do something silly, such as use lots of memory or get into loops with lots to do
- Some files will cause parsers or their underlying libraries to OOM, or infinite loop, or something else bad
- If a file fails once, will probably fail again, so blindly just re-running that task again won't help
Failure at Scale, continued

- You'll need approaches that plan for failure
- Consider what will happen if a file locks up your JVM, or kills it with an OOM
- Forked Parser may be worth using
- Running a separate Tika Server could be good
- Depending on work needed, could have a smaller pool of Tika Server instances for big data code to call
- Think about failure modes, then think about retries (or not)
- Track common problems, report and fix them!
Bonus! Tika Batch, Eval & Hadoop
Aiming to provide a robust Tika wrapper, that handles OOMs, permanent hangs, out of file handles etc

Should be able to use Tika Batch to run Tika against a wide range of documents, getting either content or an error

First focus was on the Tika App, with adisk-to-disk wrapper

Now looking at the Tika Server, to have it log errors, provide a watchdog to restart after serious errors etc

Once that's all baked in, refactor and fully-hadoop!

Accept there will always be errors! Work with that
Tika Batch Hadoop

• Now we have the basic Tika Batch working – Hadoop it!
• Aiming to provide a full Hadoop Tika Batch implementation
• Will process a large collection of files, providing either Metadata+Content, or a detailed error of failure
• Failure could be machine/enivornment, so probably need to retry a failure incase it isn't a Tika issue!
• Will be partly inspired by the work Apache Nutch does

• Tika will “eat our own dogfood” with this, using it to test for regressions / improvements between versions
Tika Eval – TIKA-1332

- Building on top of Tika Batch, to work out how well / badly a version of Tika does on a large collection of documents
- Provide comparable profiling of a run on a corpus
- Number of different file types found, number of exceptions, exceptions by type and file type, attachments etc
- Also provide information on language stats, and junk text
- Identify file types to look at supporting
- Identify file types / exceptions which have regressed
- Identify exceptions / problems to try to fix
- Identify things for manual review, eg TIKA-1442 PDFBox bug
Batch+Eval+Public Datasets

- When looking at a new feature, or looking to upgrade a dependency, we want to know if we have broken anything
- Unit tests provide a good first-pass, but only so many files
- Running against a very large dataset and comparing before/after is the best way to handle it

- Initially piloting + developing against the Govdocs1 corpus
  http://digitalcorpora.org/corpora/govdocs
- Using donated hosting from Rackspace for trying this
- Need newer + more varied corpuses as well! Know of any?
Reports include: Detection diffs

<table>
<thead>
<tr>
<th>MIME_A_TO_MIME_B</th>
<th>COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>application/vnd.ms-excel -&gt; application/vnd.ms-graph</td>
<td>27888</td>
</tr>
<tr>
<td>application/epub+zip(NEWLINE) -&gt; application/epub+zip</td>
<td>855</td>
</tr>
<tr>
<td>text/html; charset=windows-1252 -&gt; application/x-mobipocket-ebook</td>
<td>829</td>
</tr>
<tr>
<td>application/octet-stream -&gt; application/vnd.wordperfect</td>
<td>734</td>
</tr>
<tr>
<td>application/octet-stream -&gt; application/x-mobipocket-ebook</td>
<td>301</td>
</tr>
<tr>
<td>application/octet-stream -&gt; multipart/appledouble</td>
<td>280</td>
</tr>
<tr>
<td>text/html; charset=windows-1252 -&gt; text/plain; charset=windows-1252</td>
<td>239</td>
</tr>
<tr>
<td>image/jpeg -&gt; multipart/appledouble</td>
<td>169</td>
</tr>
<tr>
<td>model/vnd.dwf -&gt; model/vnd.dwf; version=6</td>
<td>156</td>
</tr>
<tr>
<td>video/mp4 -&gt; application/mp4</td>
<td>102</td>
</tr>
<tr>
<td>text/html; charset=UTF-8 -&gt; application/xhtml+xml; charset=UTF-8</td>
<td>102</td>
</tr>
<tr>
<td>application/x-tika-ooxml -&gt; application/vnd.ms-excel.sheet.macroenabled.12</td>
<td>96</td>
</tr>
<tr>
<td>application/x-tika-ooxml -&gt; application/vnd.openxmlformats-officedocument.presentationml.presentation</td>
<td>90</td>
</tr>
<tr>
<td>text/plain; charset=UTF-8 -&gt; text/plain; charset=ISO-8859-1</td>
<td>76</td>
</tr>
<tr>
<td>image/png -&gt; multipart/appledouble</td>
<td>74</td>
</tr>
<tr>
<td>application/octet-stream -&gt; application/x-shapefile</td>
<td>66</td>
</tr>
</tbody>
</table>
Any Questions?