Image Data Storage

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OME

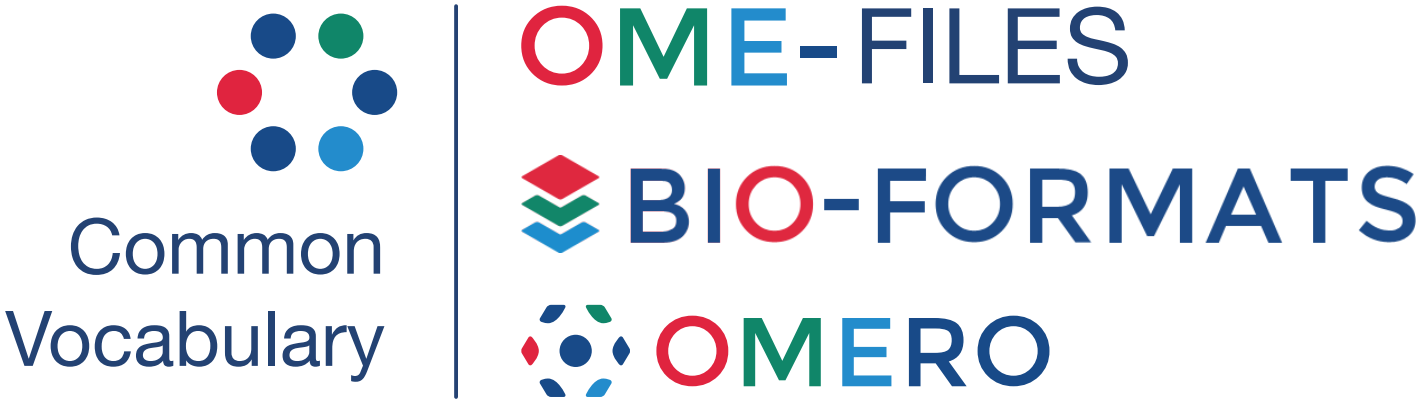
IDR

Outline

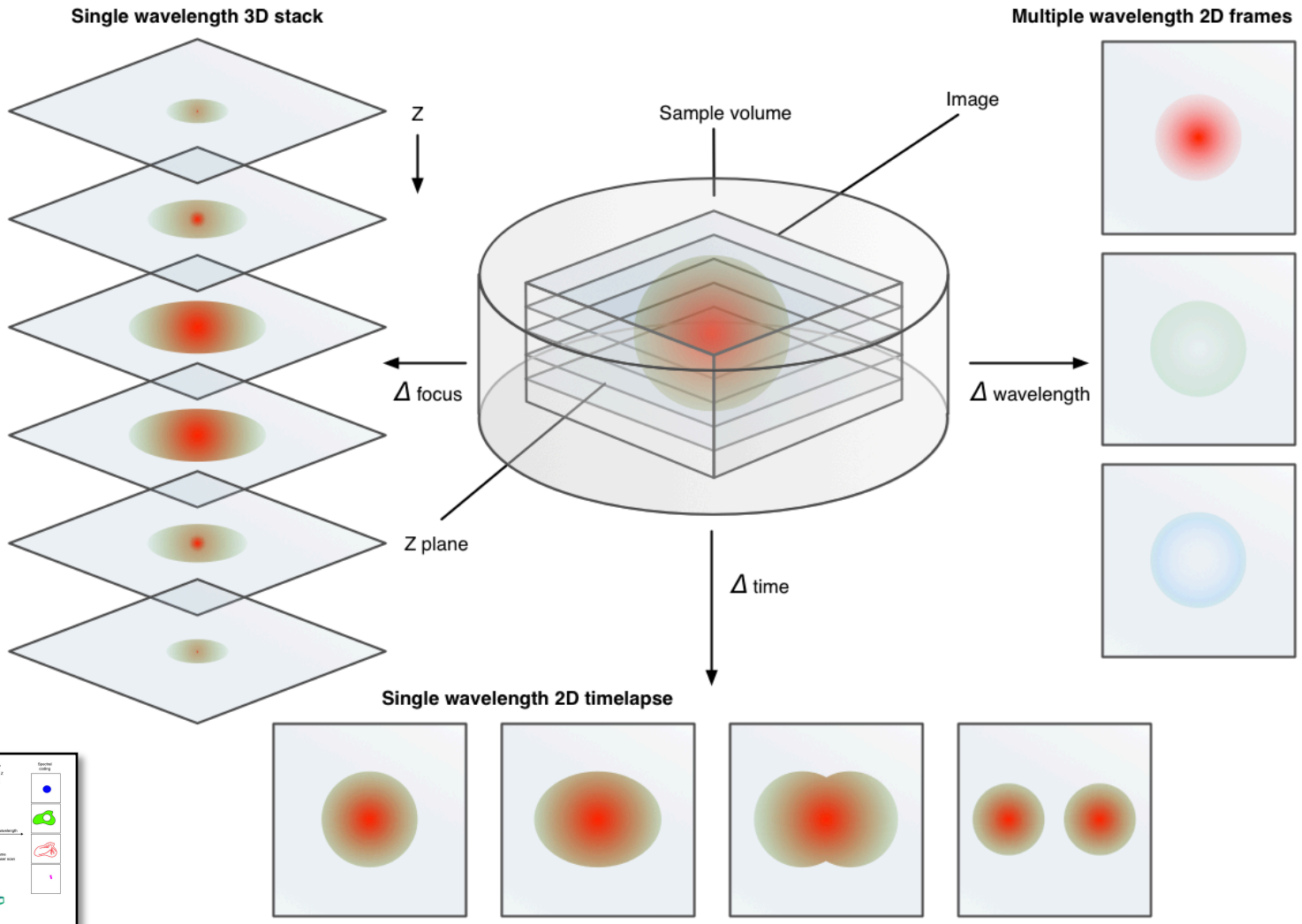
- OME definition of `Image`
- File-formats
  - Current storage
  - Challenges, etc.
- Object storage
  - Expectations
  - Cost/Value
  - Requirements

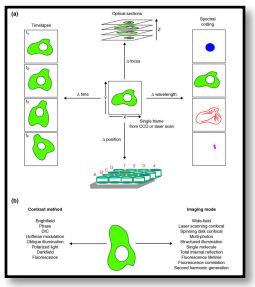
IMAGES

OME Strategy



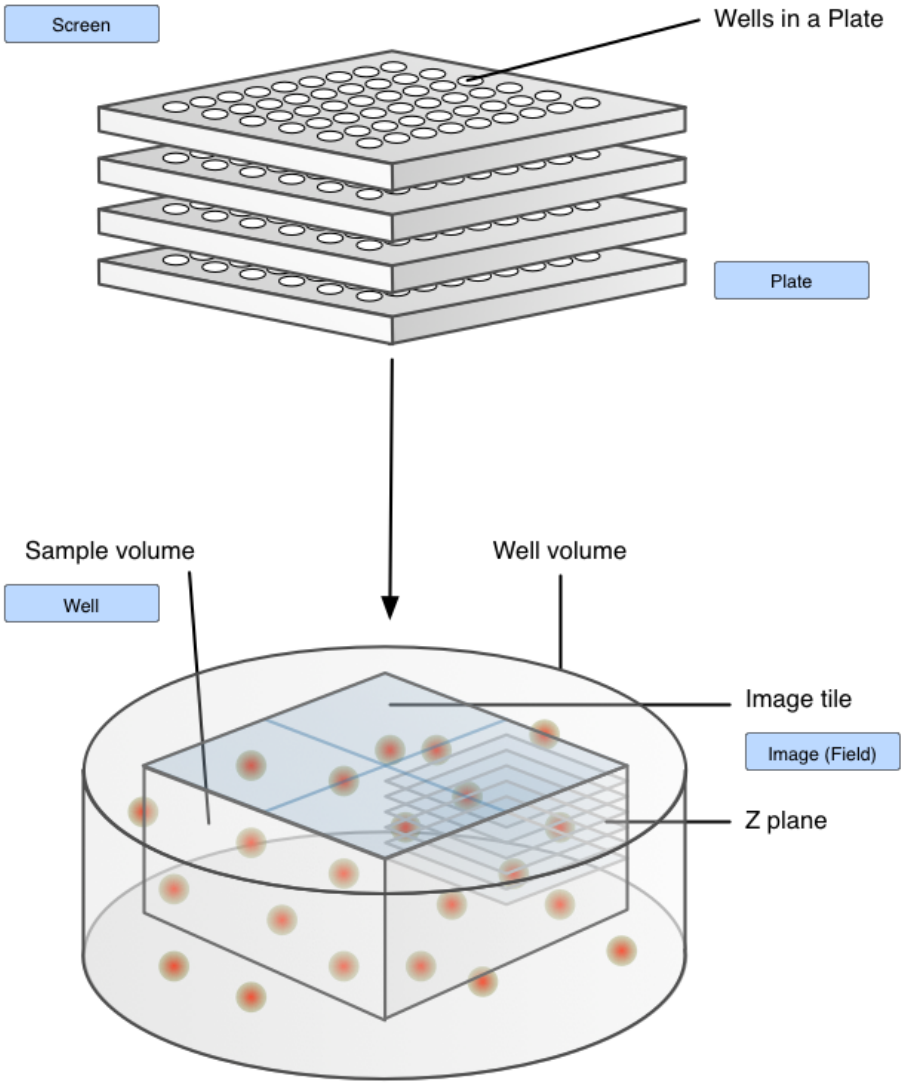
Spatio-temporal dimensions + measurements





https://genomebiology.biomedcentral.com/articles/10.1186/gb-2005-6-5-r47

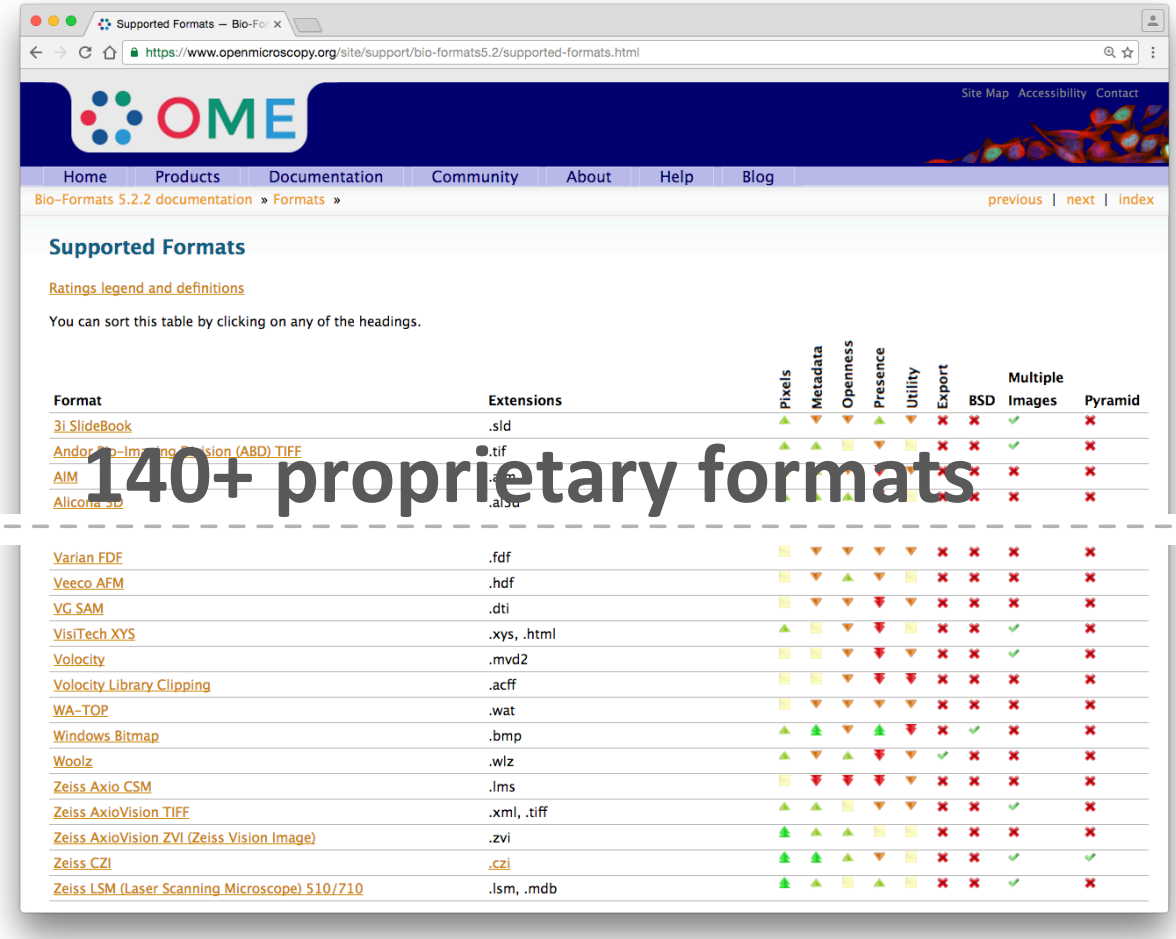
High-content screening dimensions



https://docs.openmicroscopy.org/ome-model/5.5.7/developers/screen-plate-well.html

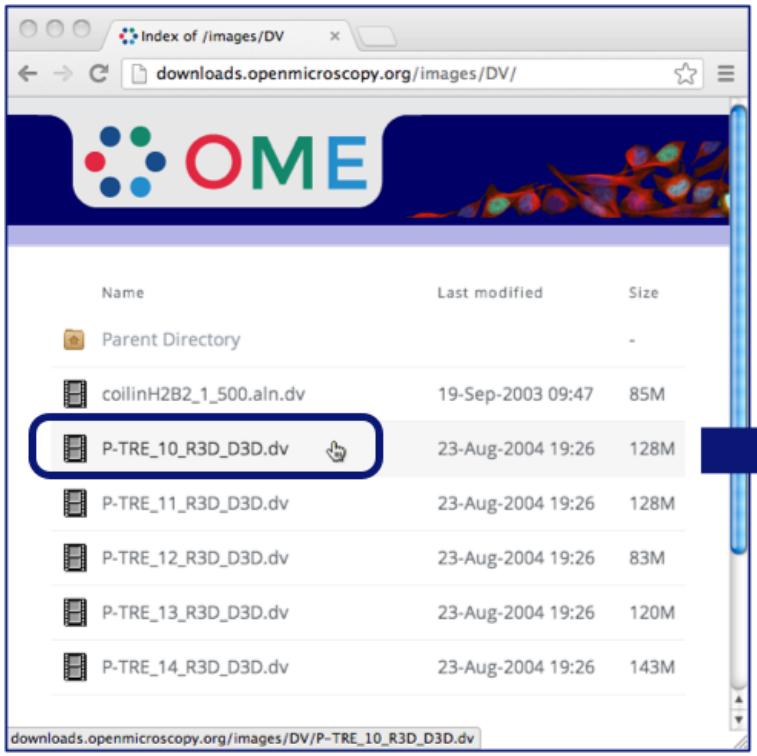
FILE-FORMATS

Bio-Formats



140+ proprietary formats

Filesets: 1-1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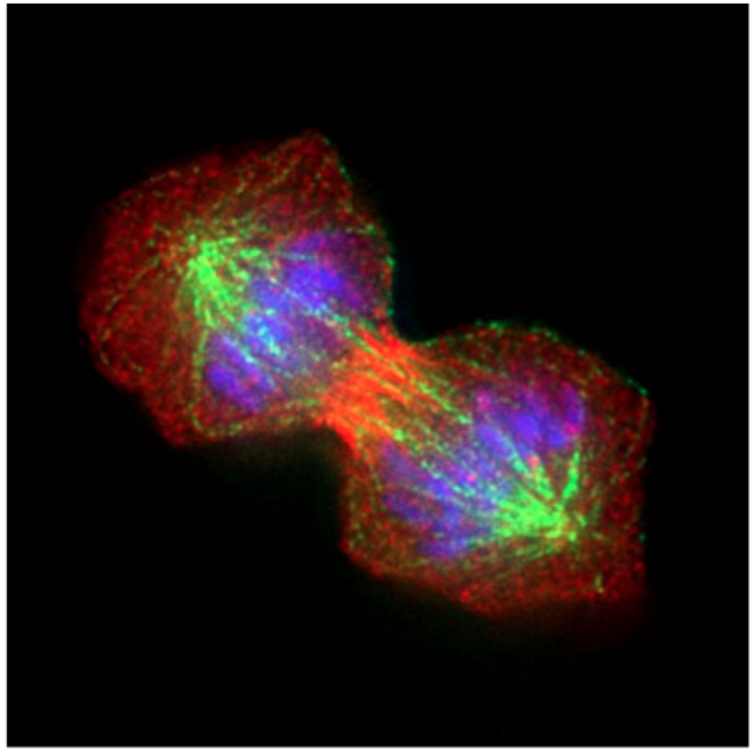
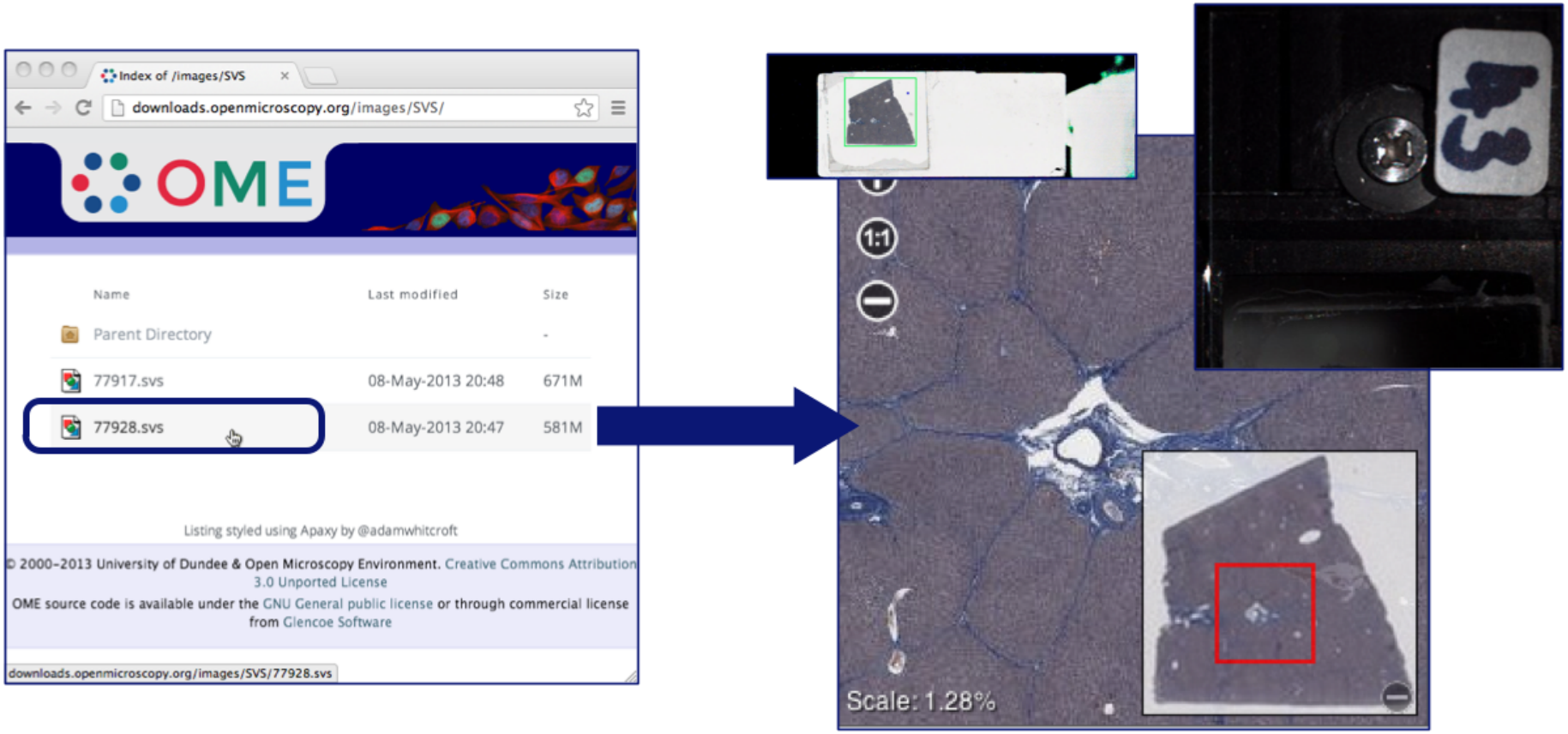


Filesets: 1-N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08-May-2013 20:47
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Listing styled using Apaxy by @adamwhitcroft
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OME source code is available under the GNU General public license or through commercial license from Glencoe Software
downloads.openmicroscopy.org/images/SVS/77928.svs
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Scale: 1.28%

Filesets: N-N


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Fileset Diversity

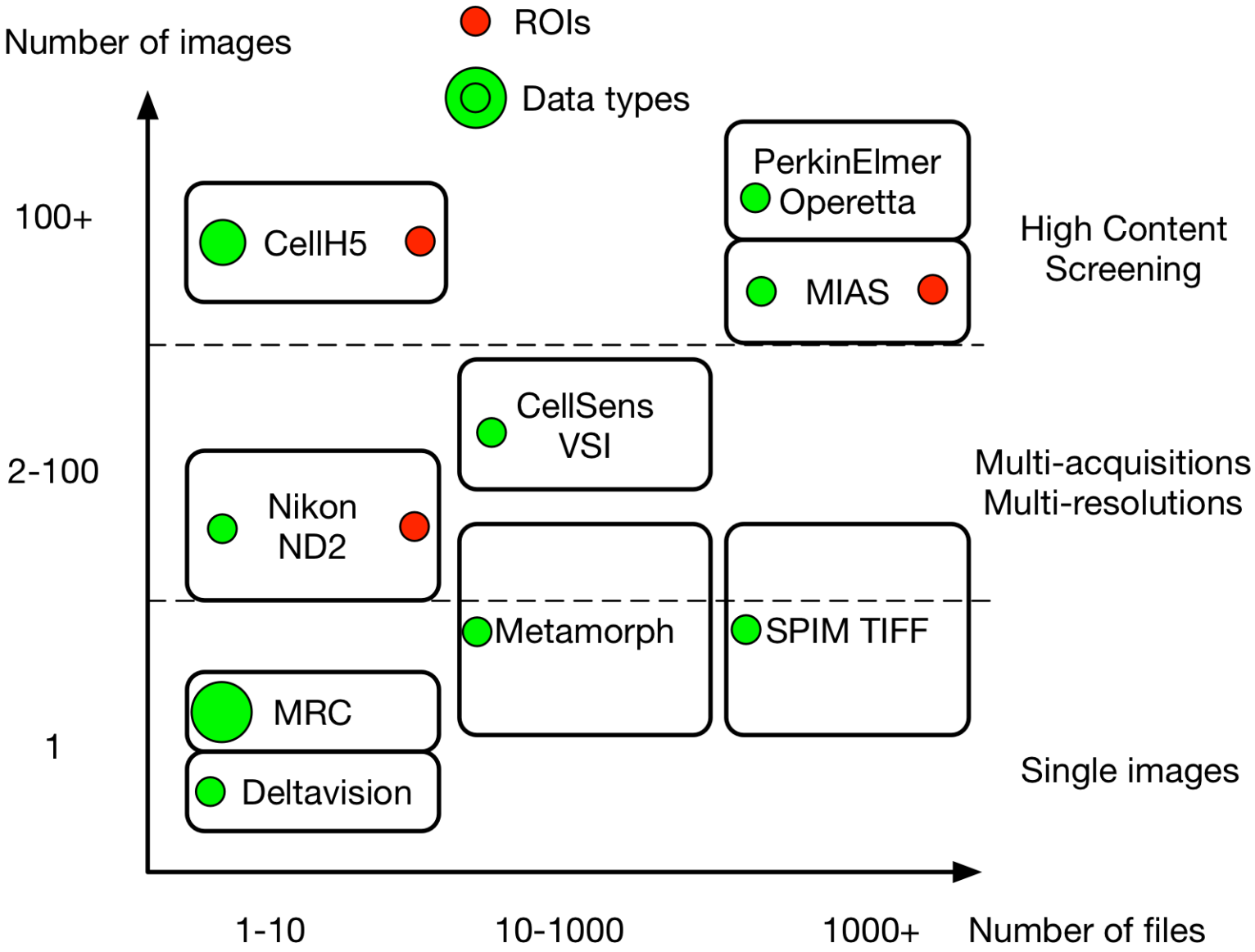
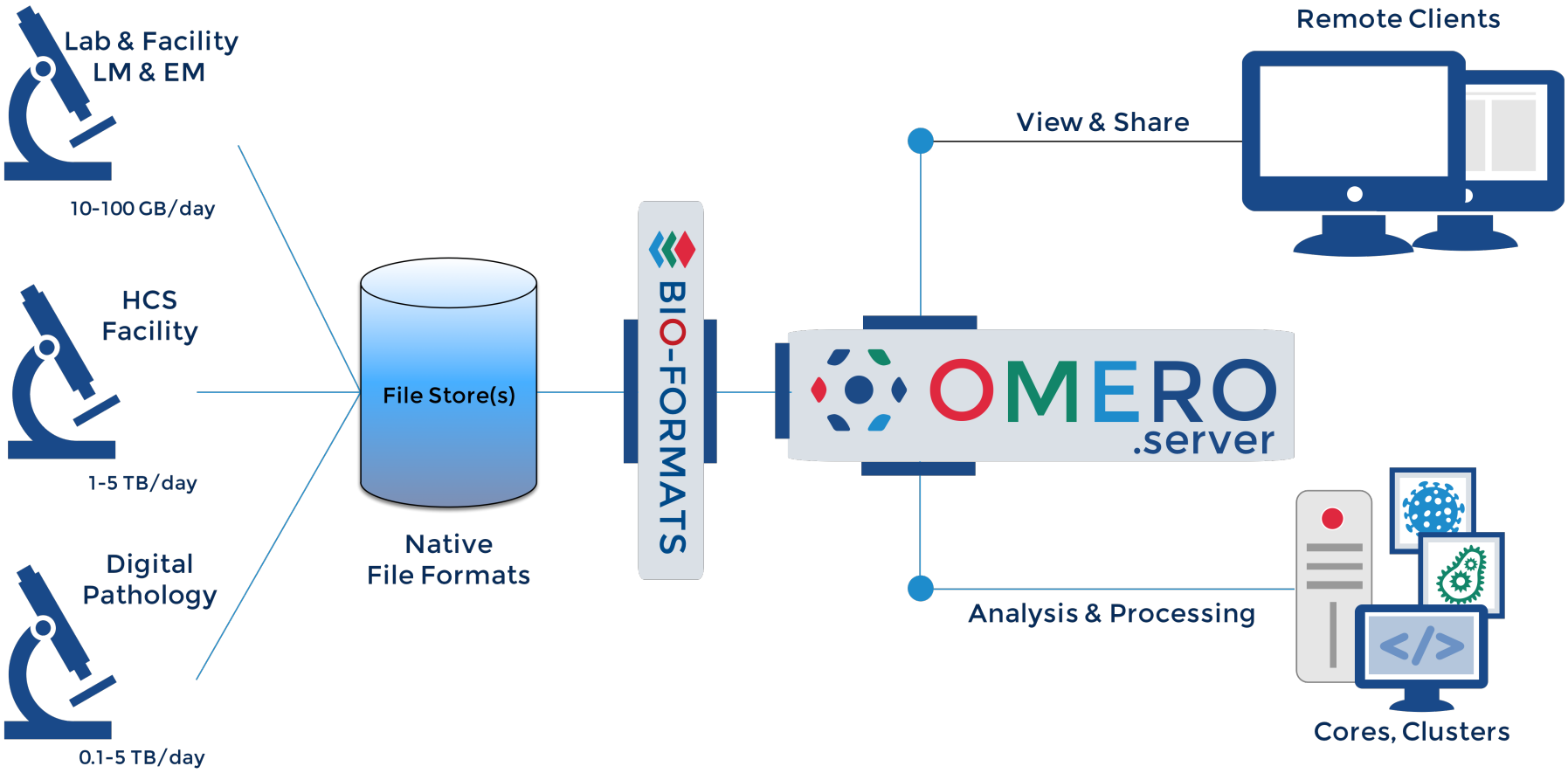
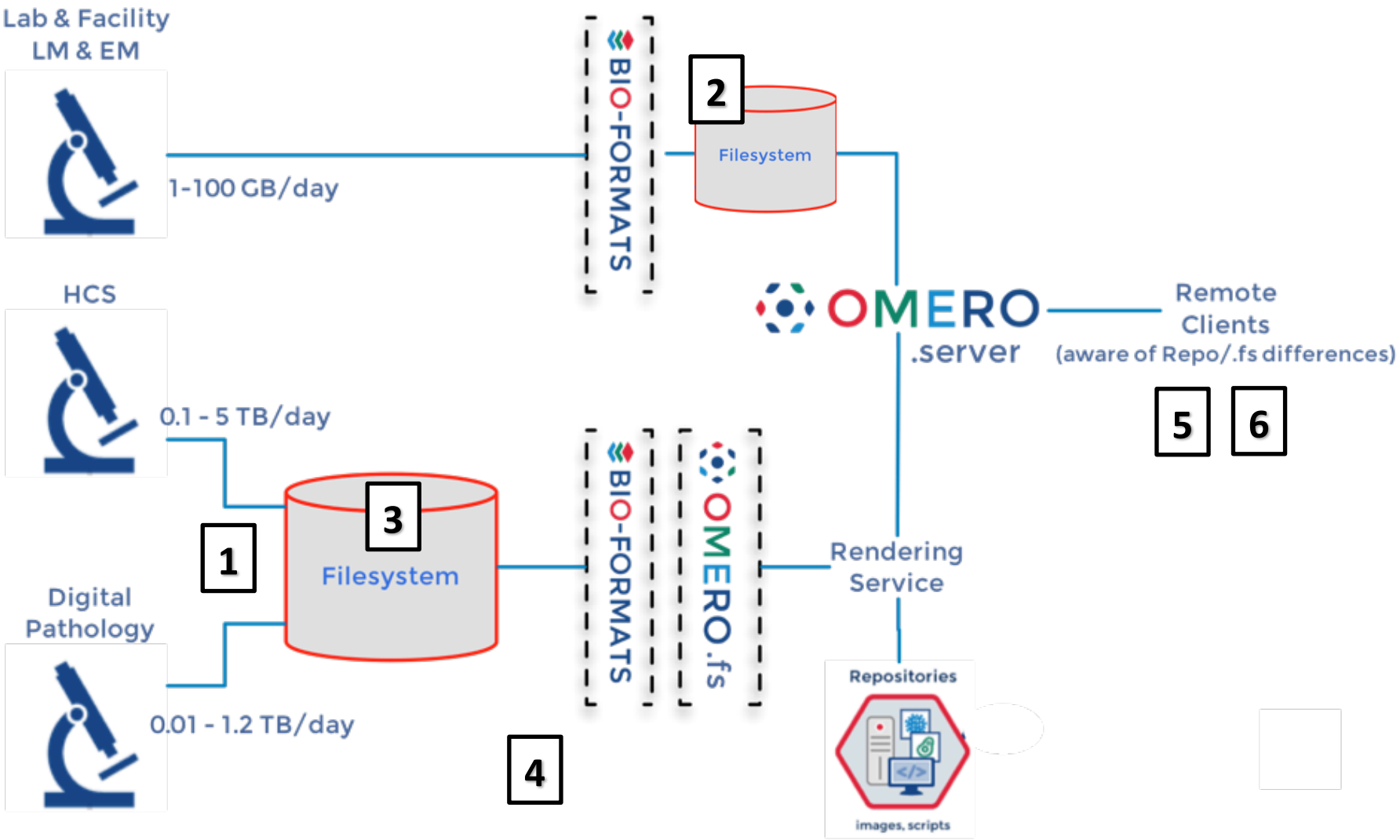


Image Data Access: Today

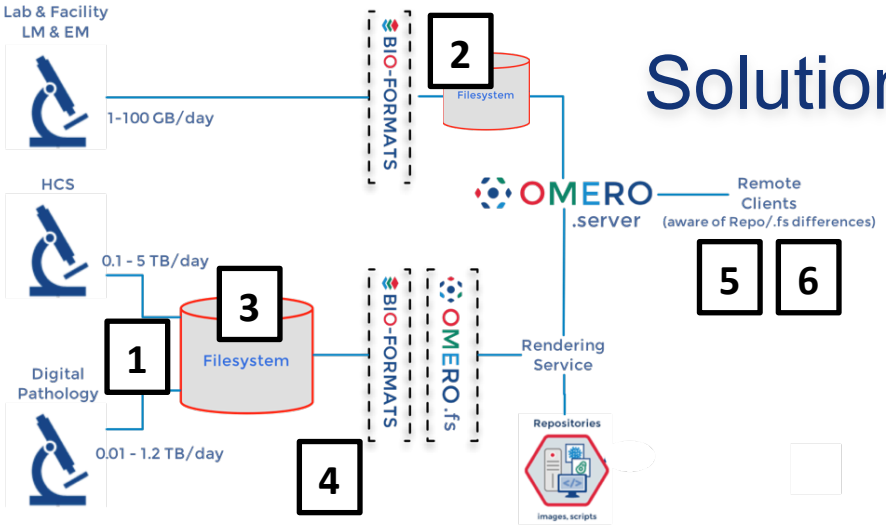


OBJECT-STORES

Image Data Access: Past & Future



Solution Trade-offs



		Scope	Latency	Storage	Value	ETA
1	Filesystem cache	Backend cache	Slow once	>1x	Fast & simple	Straight-forward once defined
2	Direct storage (“ROMIO”)	Swappable backend	Slow **always**	1	Space-efficient	Requires new import strategy
3	Reader/Writer	Supported format	Slow **always**	1	Stability	**Longest; requires spec**
4	Plane/chunk cache	Flexible layer	Slow once	>1x	Can be combined	Relatively simple
5	Client loads from S3	Full S3 integration	*Potentially fast*	1	Most “modern”	Requires significant changes
6	Client caches to S3	Frontend cache	Slow once	>1x	Trans-parent	Simple

Questions

- Will the object store be the primary storage?
  - Assuming: yes
- Will the files be deleted?
  - Assuming: yes
- Will the storage be file-based?
  - Strongly urge: **no**
- Will multi-resolutions be stored/generated?
  - Assuming: yes
- Will orthogonal views be needed? 2D needed?
  - Probably, but what's the default? e.g. XYZCT
- Will multi-fileset correlation be needed?

Last thoughts

- Caching as alternate views
- Diversity of acquisition, usage & domains
- Cost of proprietary formats
- Single API vs. maintenance burden
- Relationship to file-based solutions (HDF5)

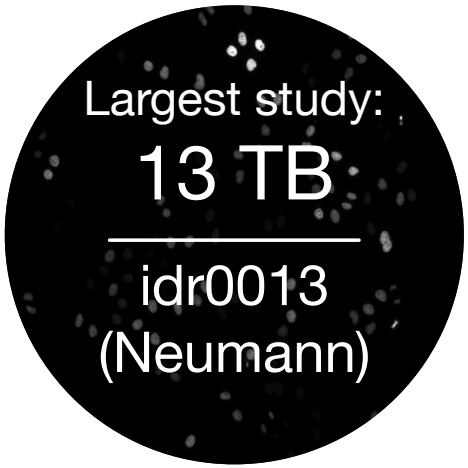
THANKS

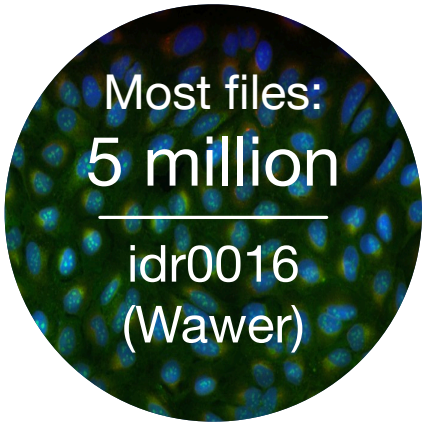
EXTRA SLIDES

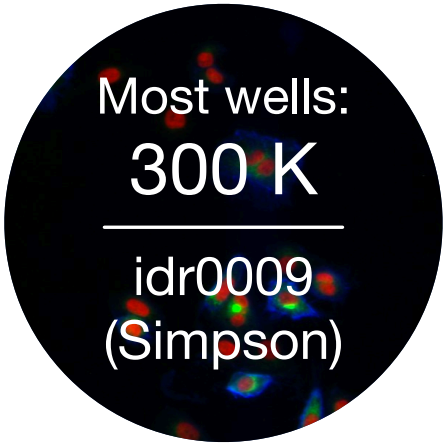
How to Source Data

IDR

Fileset challenges



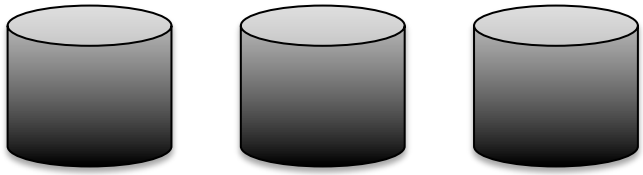




Reference images

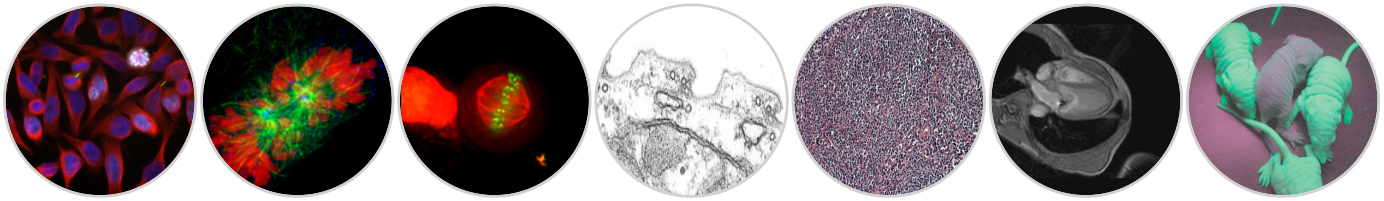
IDR

Biomolecular Resources



Genes Compounds Cell Lines

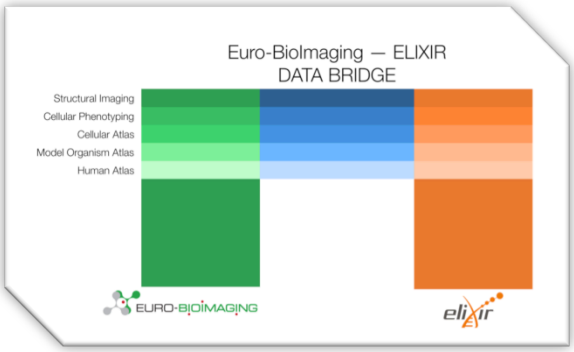
Imaging Domains



Controlled Vocabularies

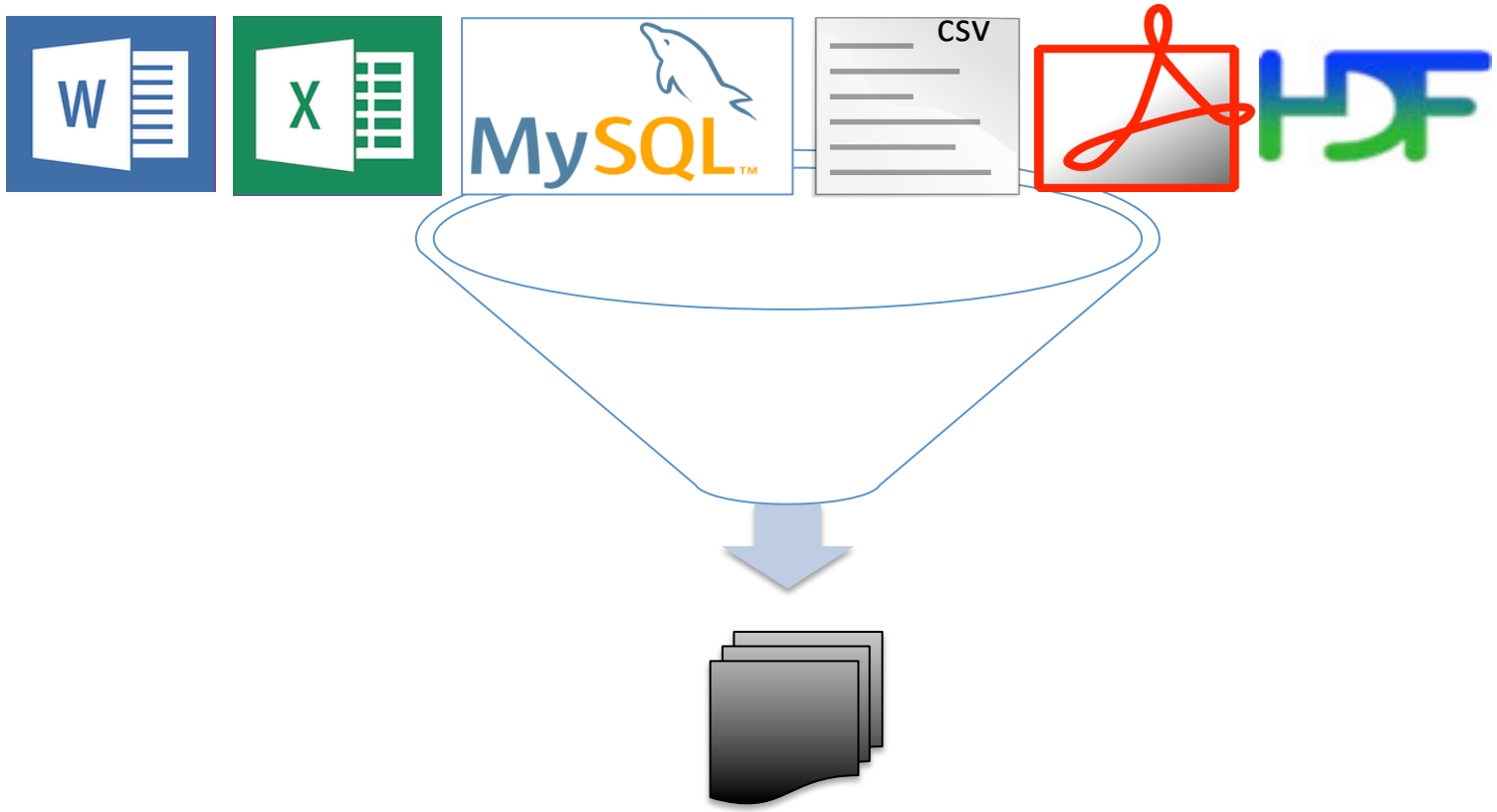
Phenotypes

Ground Truth



Google: “Euro-BioImaging/Elixir Data Strategy”

Submitted metadata



In the style of: MAGE-TAB isatab *or,* Cellular Phenotype Database

http://github.com/IDR/idr-metadata

Vital Stats: IDR @ EBI Embassy

IDR

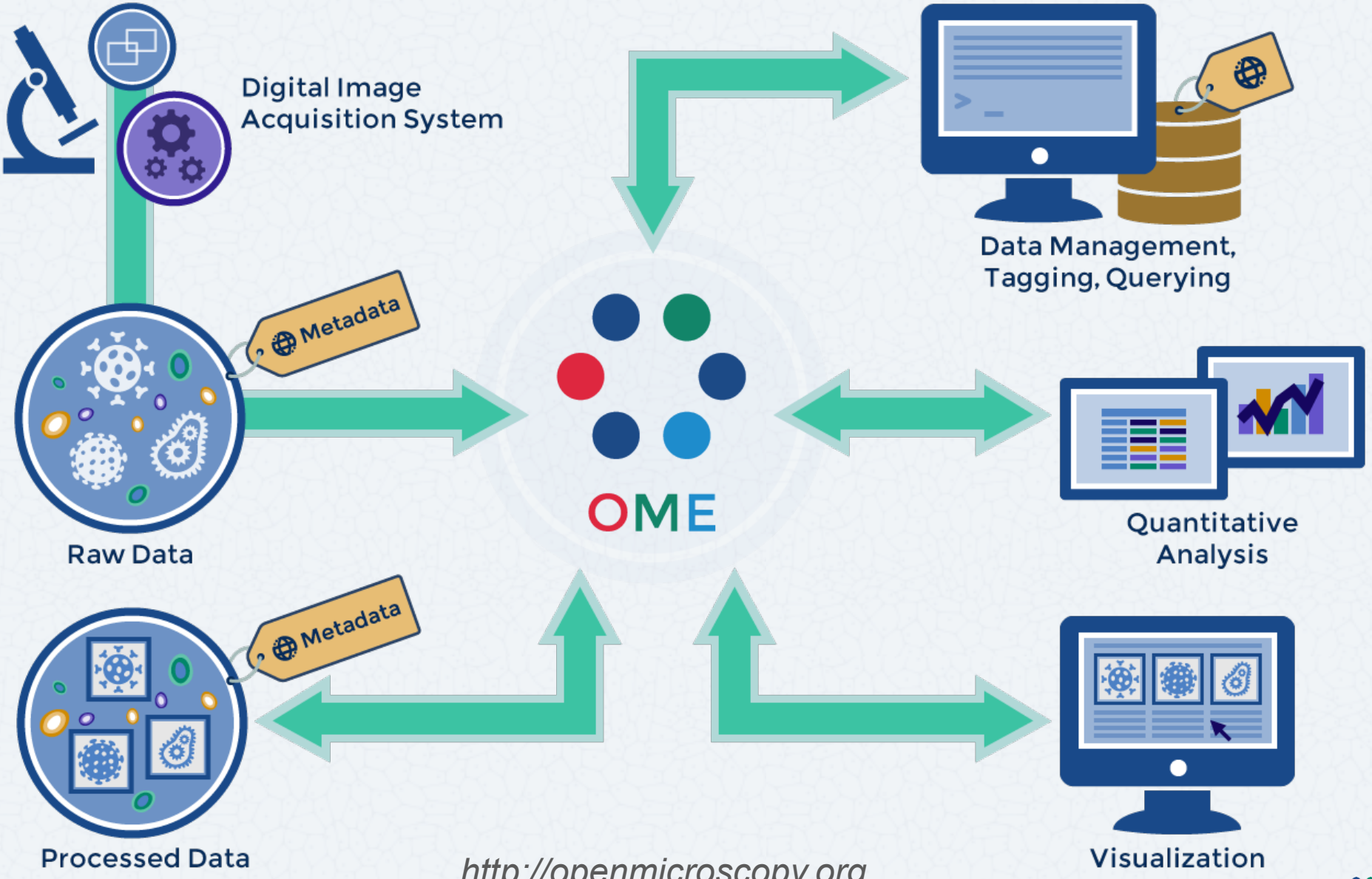
http://idr.openmicroscopy.org

Metric	Sept 2017
Image Data Size	42.8 TB
Image files	14.6 M
Datasets	3805
Total Images	2.68 M
Planes	37.3 M
Experiments	1.04M
Genes	19,605
Annotated Images	386 k
Phenotypic Classes	161
External Links	172 k

→~$25,000/month on AWS←

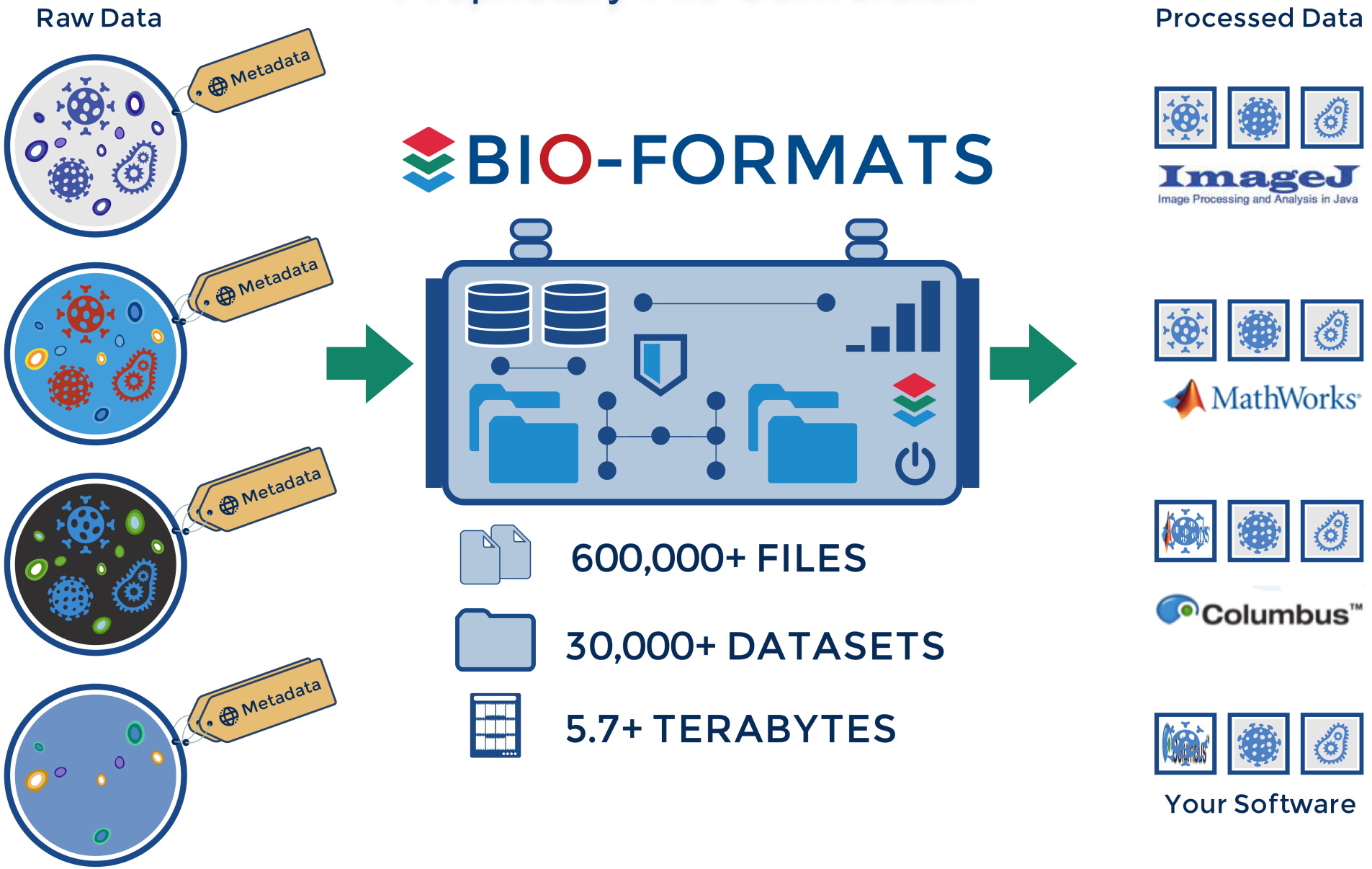
Williams et al (2017) Nature Methods

…Towards Image Informatics



http://openmicroscopy.org

BIO-FORMATS:
Proprietary File Conversion



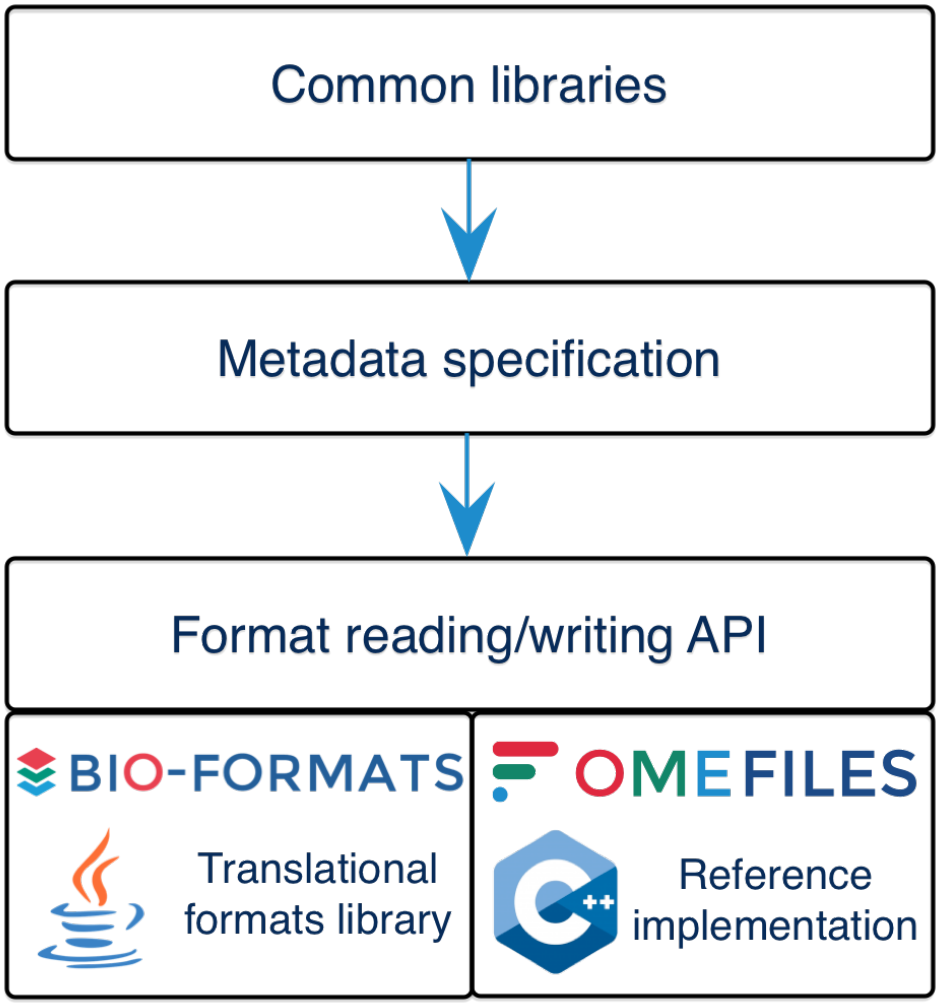
→ Apps using Bio-Formats were started >100,000 times per day in 2015 ←

BIO-FORMATS:
Opportunities for Academic/Commercial Collaborations

- 3i: Building and maintaining a SlideBook file format reader
- PerkinElmer: Commissioning Glencoe to provide open source Harmony HCS format reader
- ZEISS: Commissioning Glencoe to build open source JPEG-XR decoder

→ *See blog.openmicroscopy.org for more info*

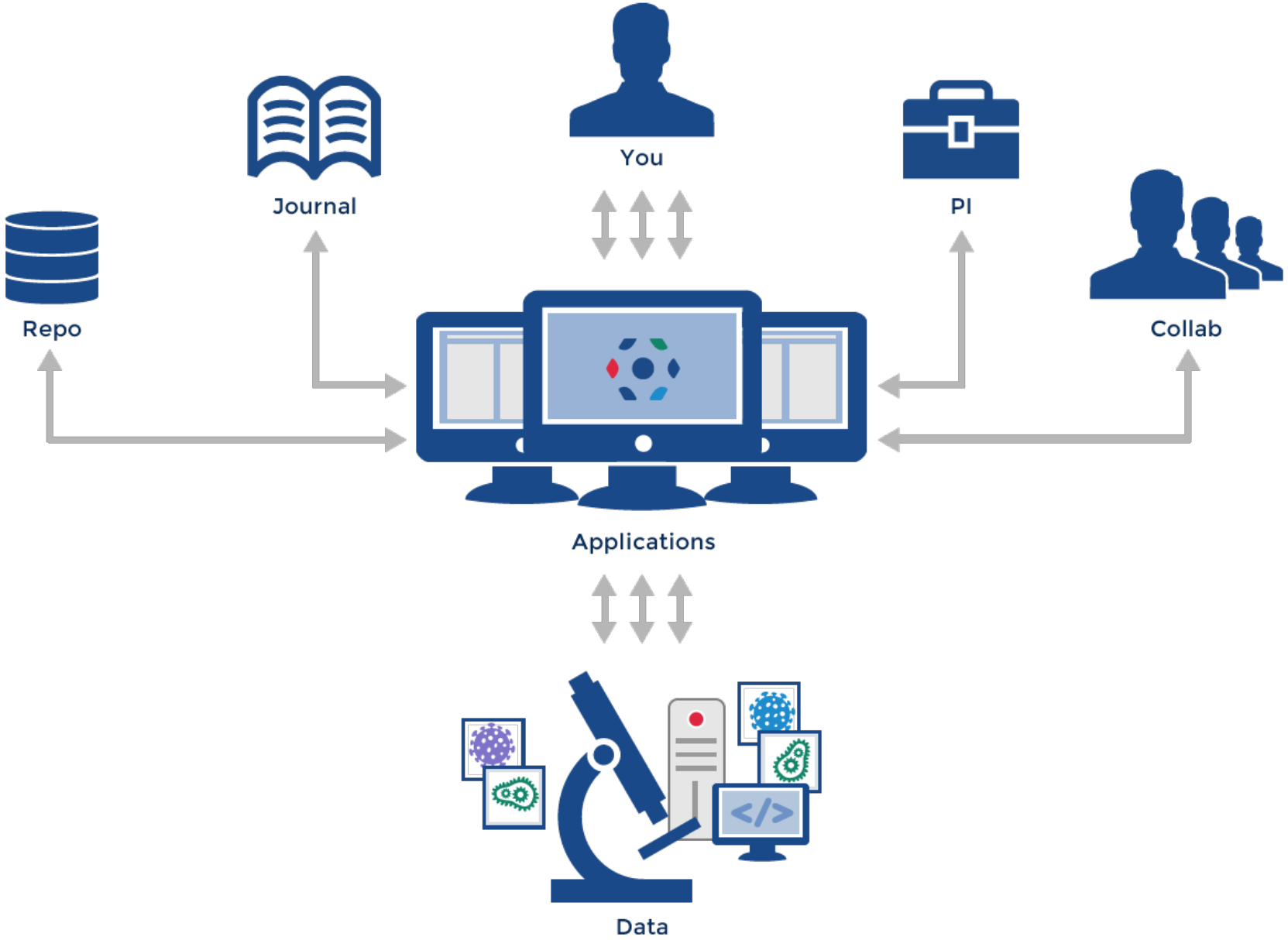
Software Stack



https://docs.openmicroscopy.org/ome-model/5.5.7/developers/screen-plate-well.html

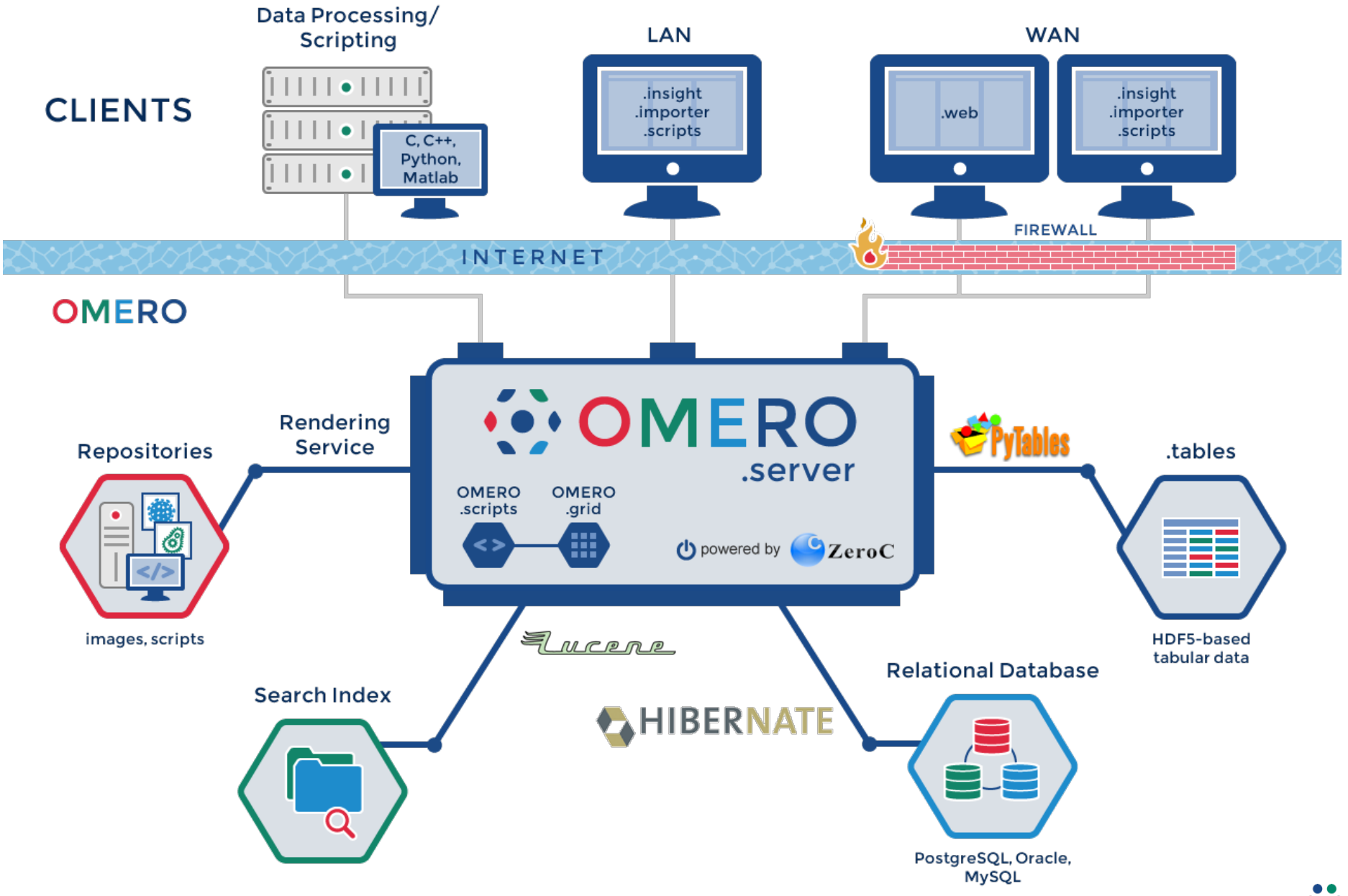
The Standard Paradigm

The “Scientific Data” Paradigm



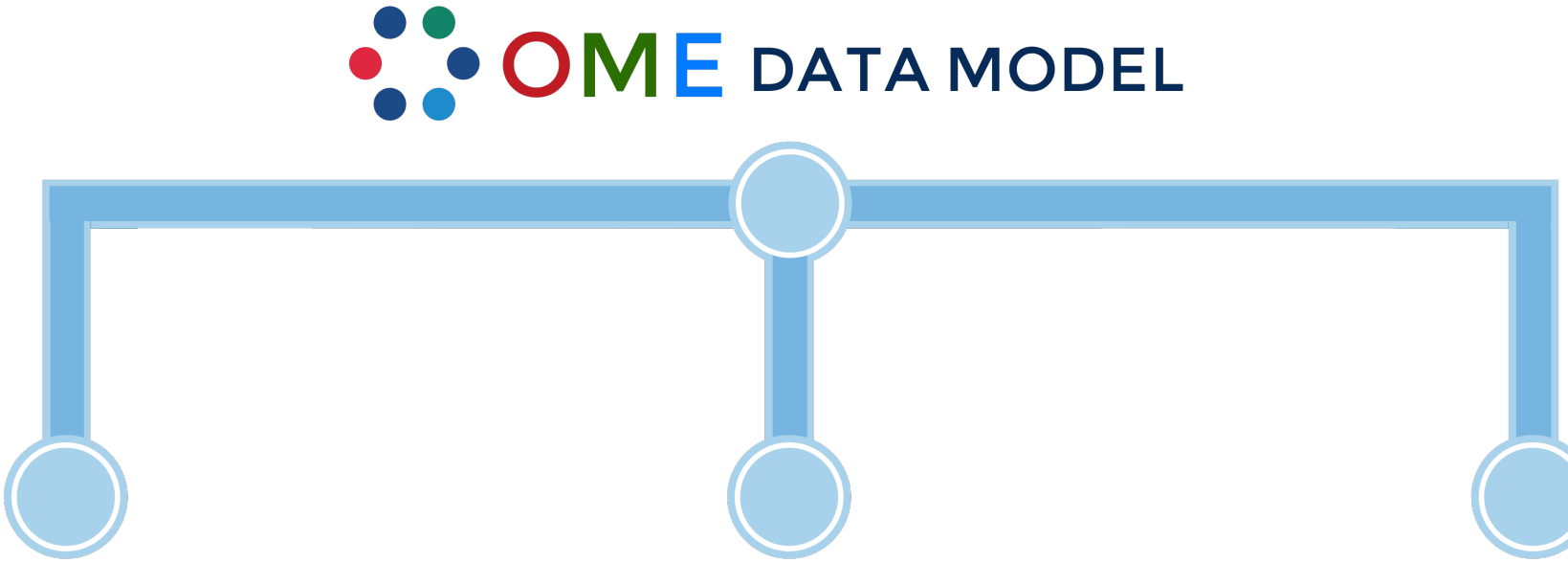
Gray et al, 2005, Scientific Data Management in the Coming Decade, Microsoft Research

The OMERO Platform

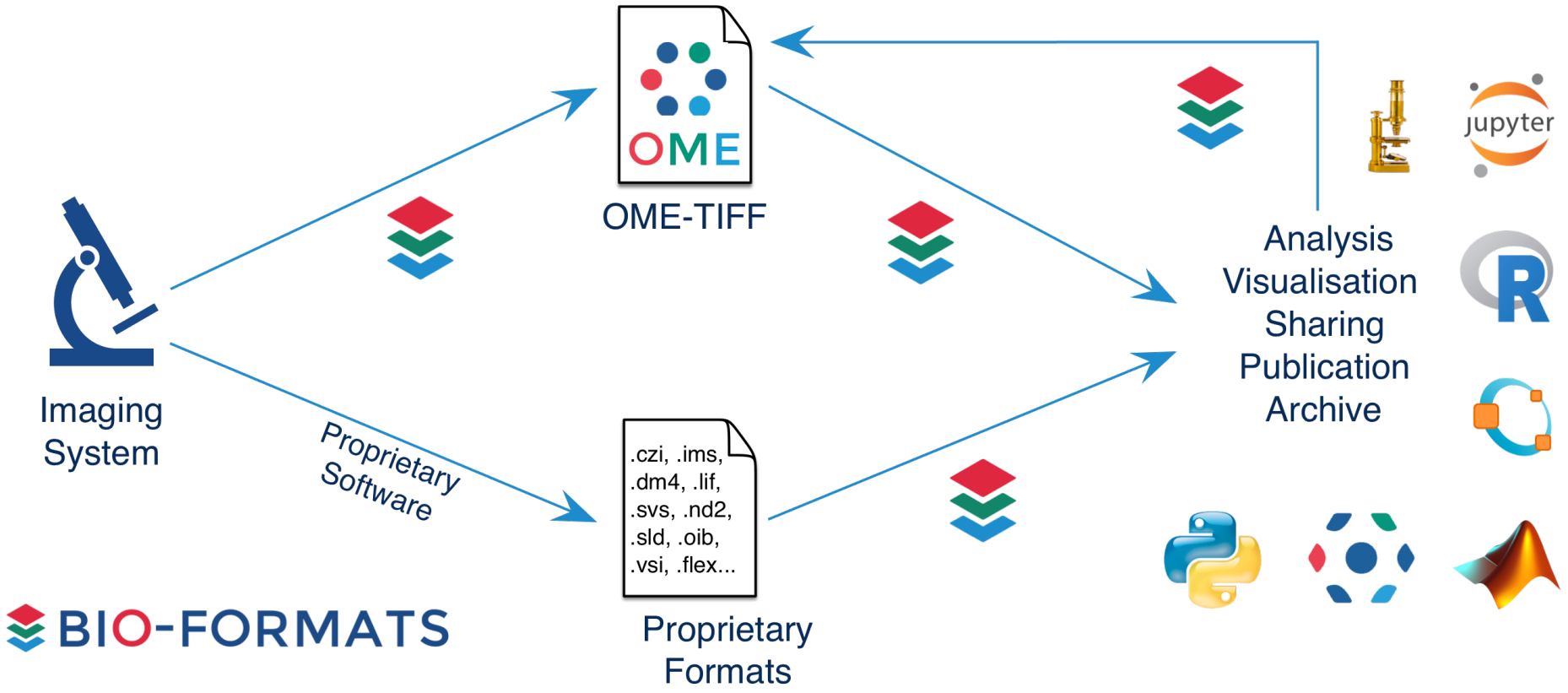


Allan et al, 2012, Nature Methods

What We Do


OME DATA MODEL
OME-XML
OME-TIFF
OME FILES
Open exchangeable file formats & metadata
BIO-FORMATS
Open Proprietary File Format Translation
OMERO
Open Image Data Management

Bio-Formats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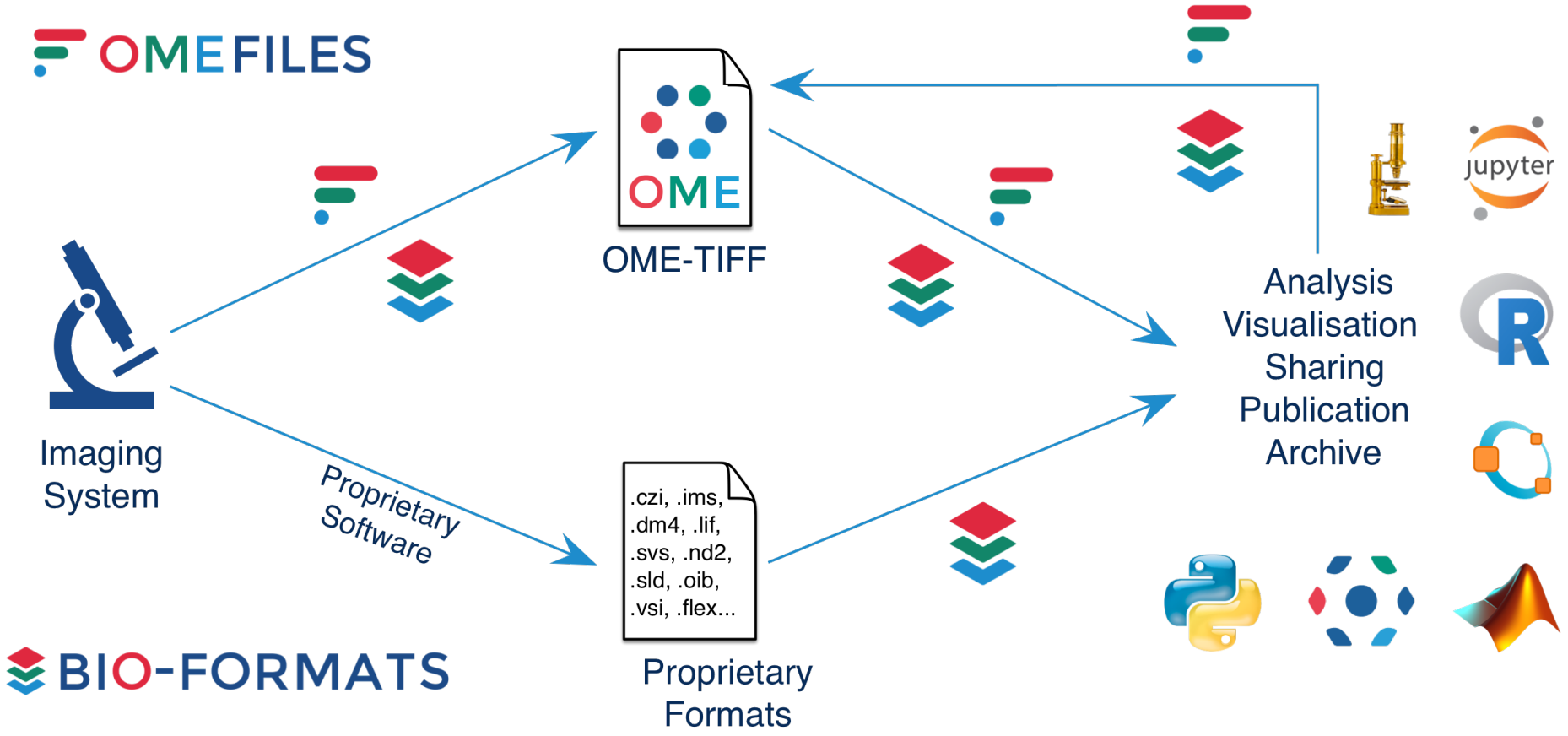
BIO-FORMATS

Bio-Formats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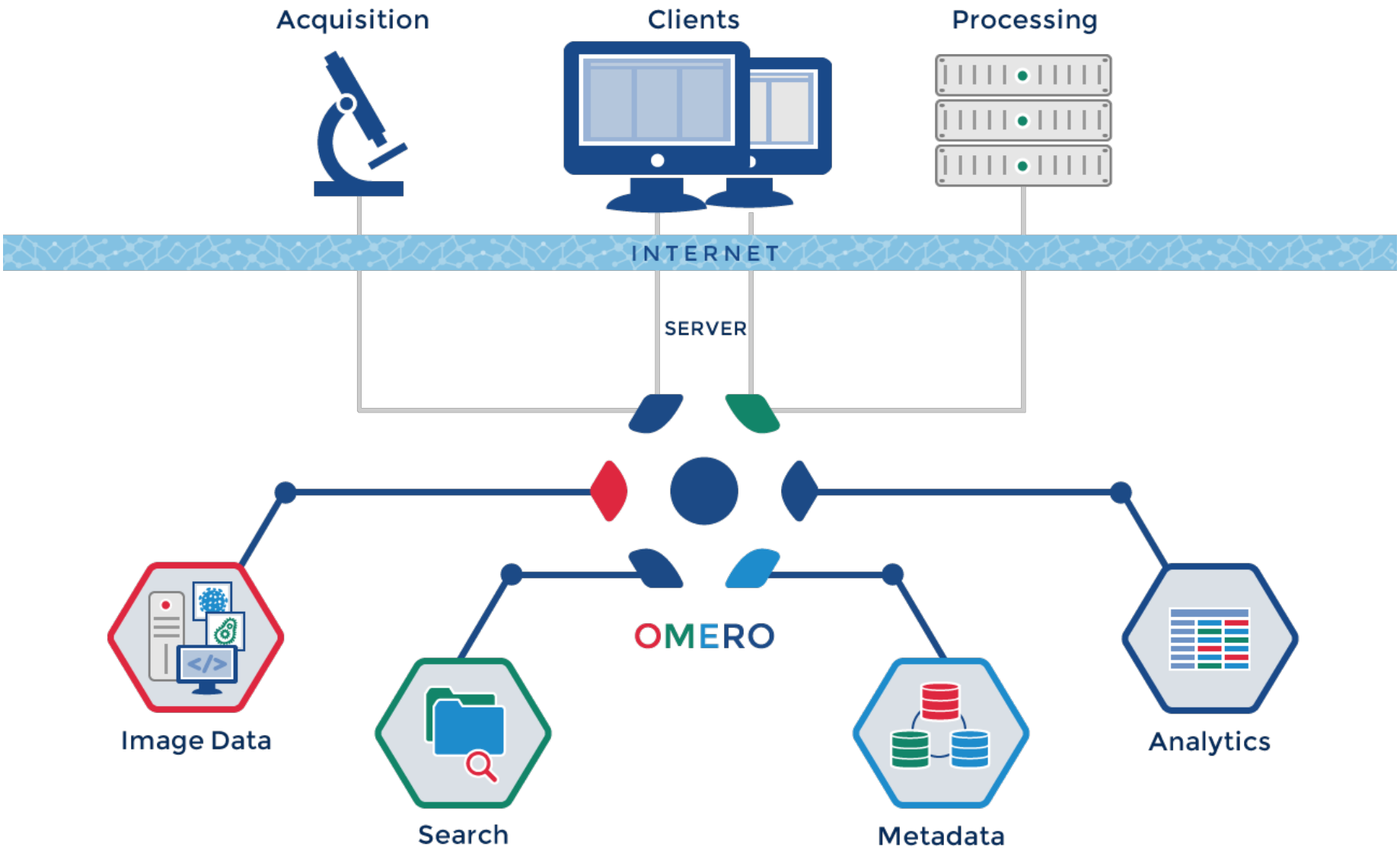
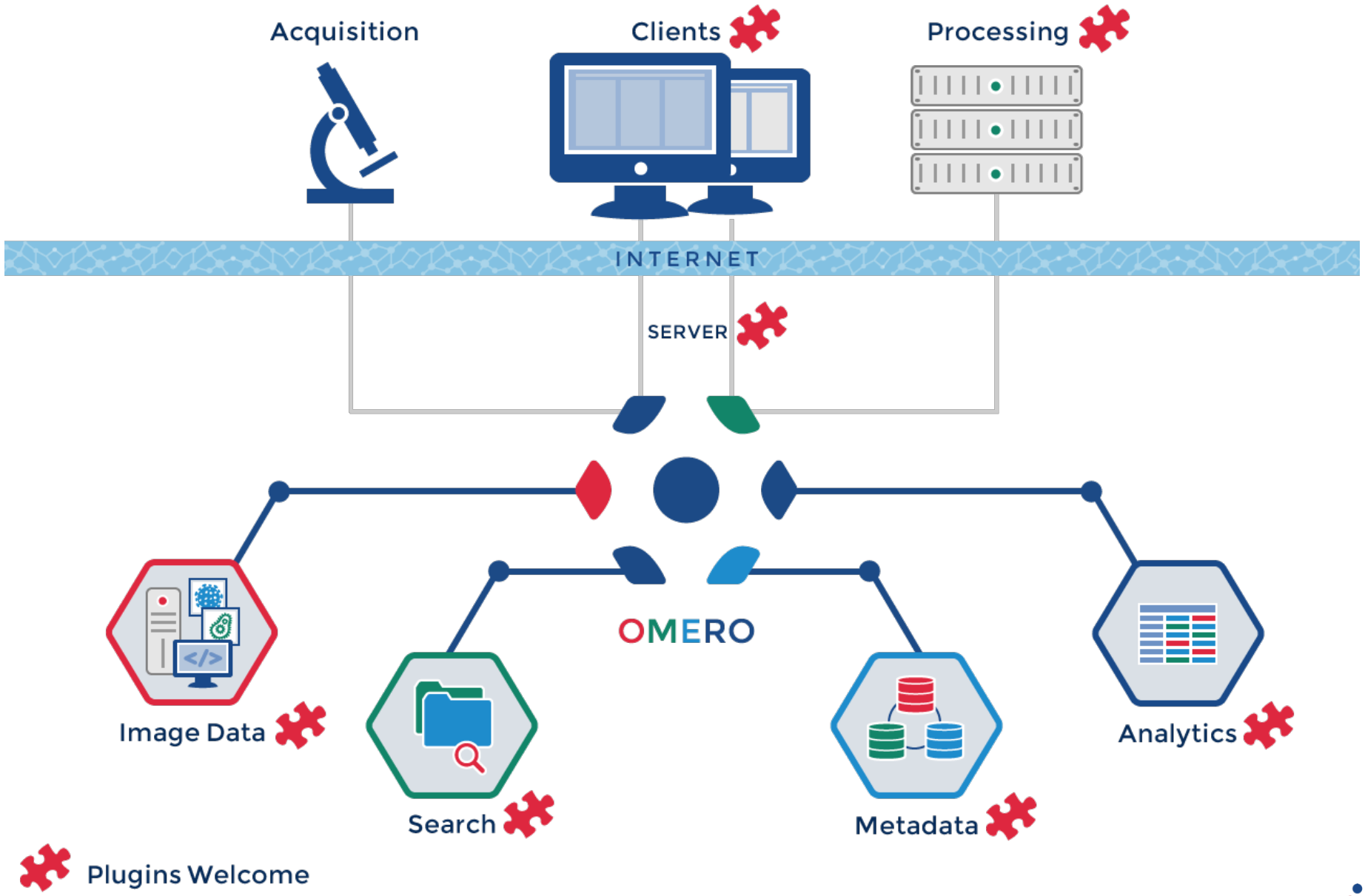
BIO-FORMATS

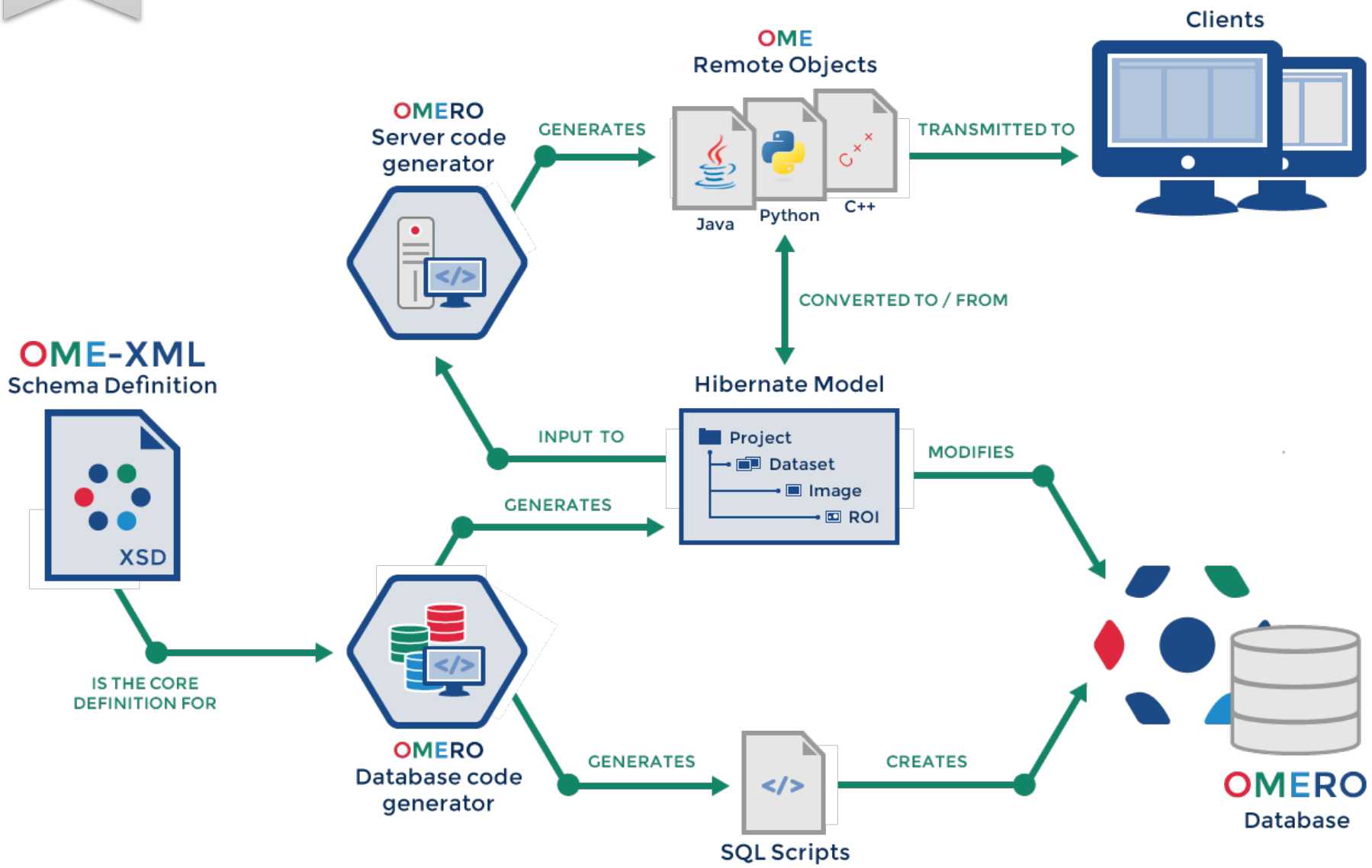
The OMERO Platform



The *Extensible* OMERO Platform



Leveraging the OME Data Model

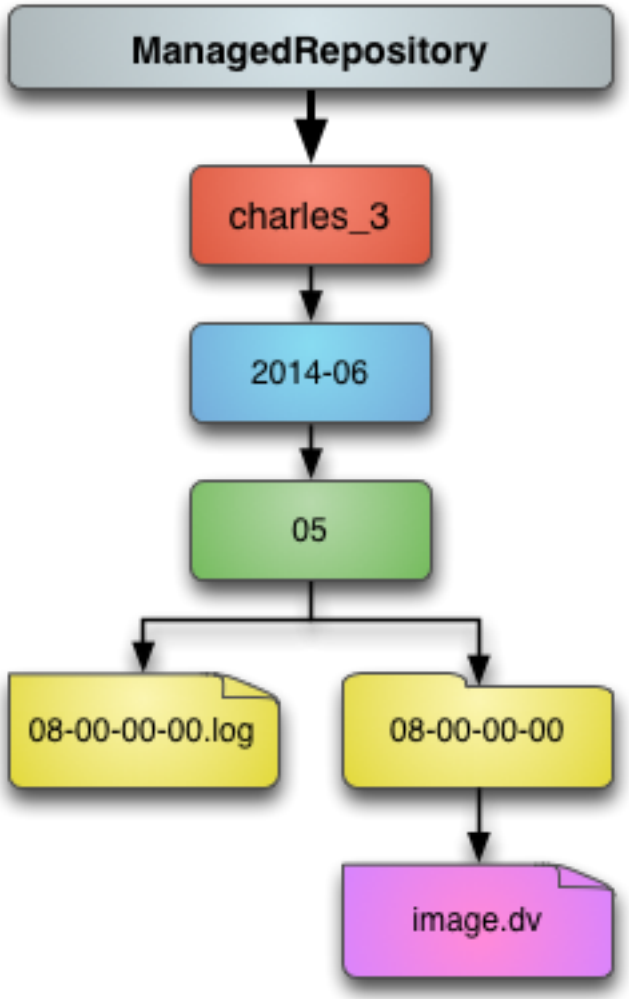


Google: ‘Extending OMERO’

Security Model

PERMISSIONS	Read	Annotate	Write	Privacy
Private	✓	✓	✓	You
Group-Read	✓	✗	✗	
Group-Annotate	✓	✓	✗	Your Group
Group-Write	✓	✓	✓	
Public-Read	✓	✗	✗	
Public-Annotate	✓	✓	✗	Anyone
Public-Write	✓	✓	✓	

Filesets: 1-1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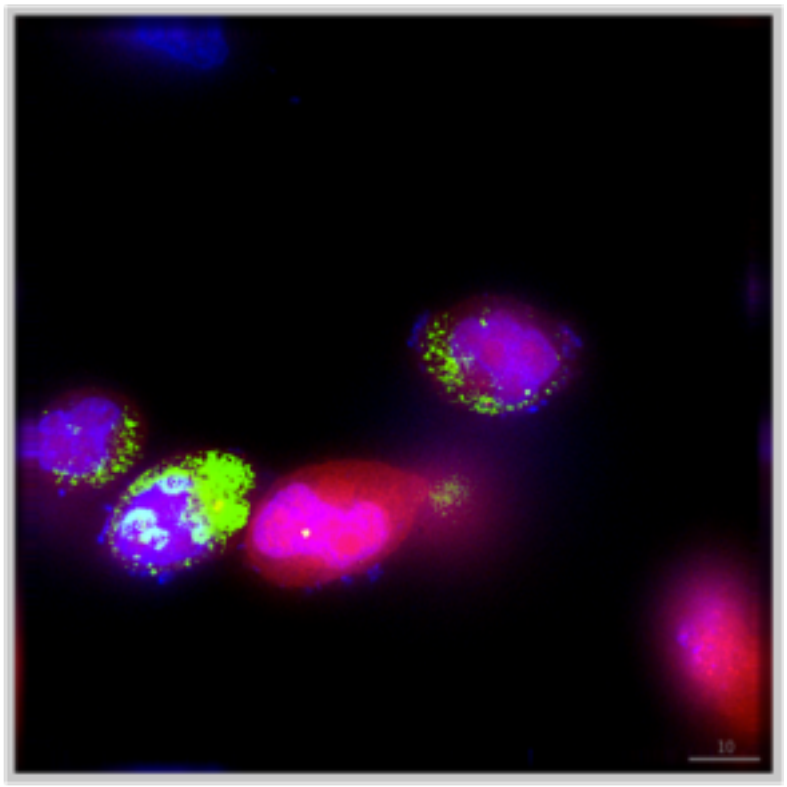

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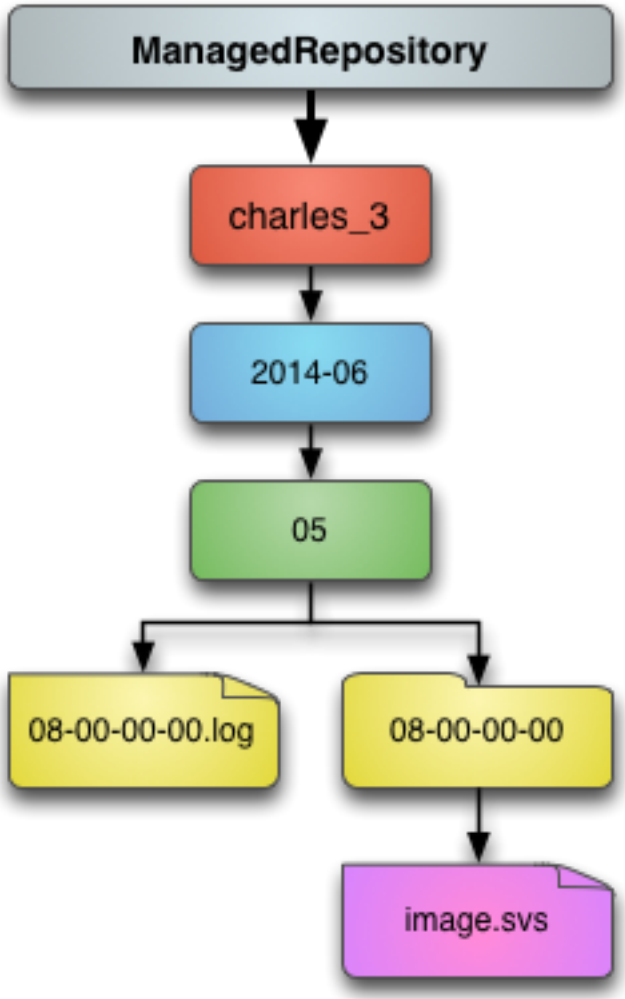
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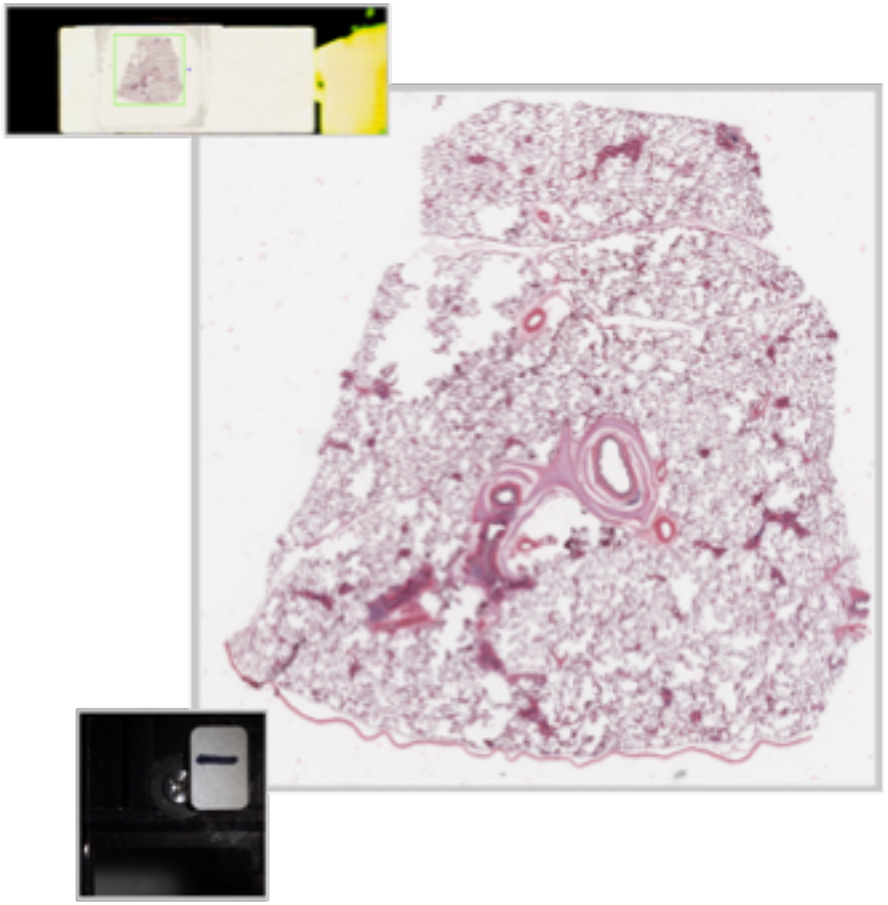

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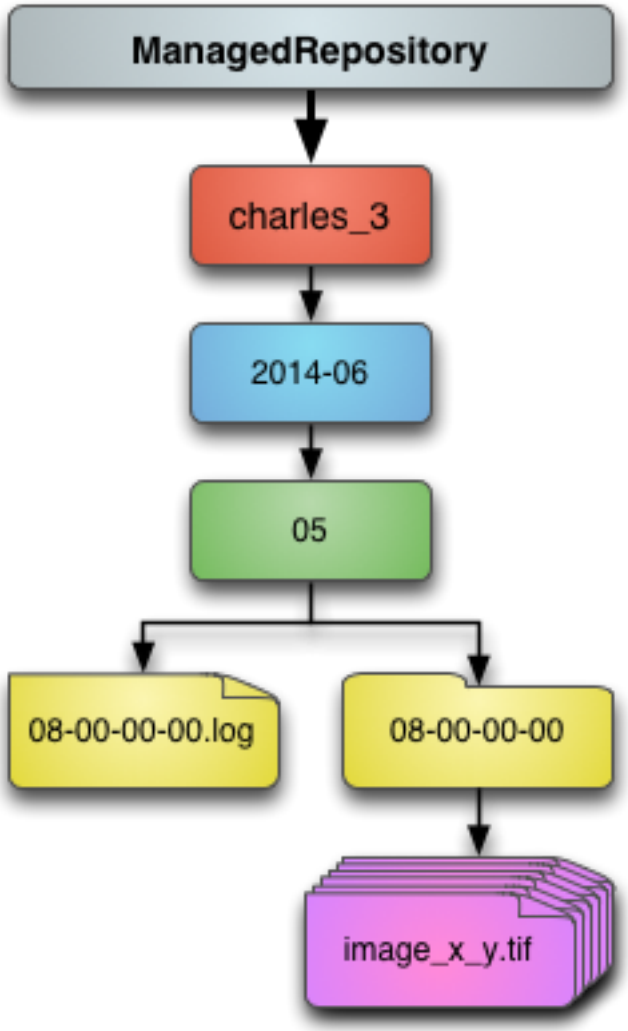
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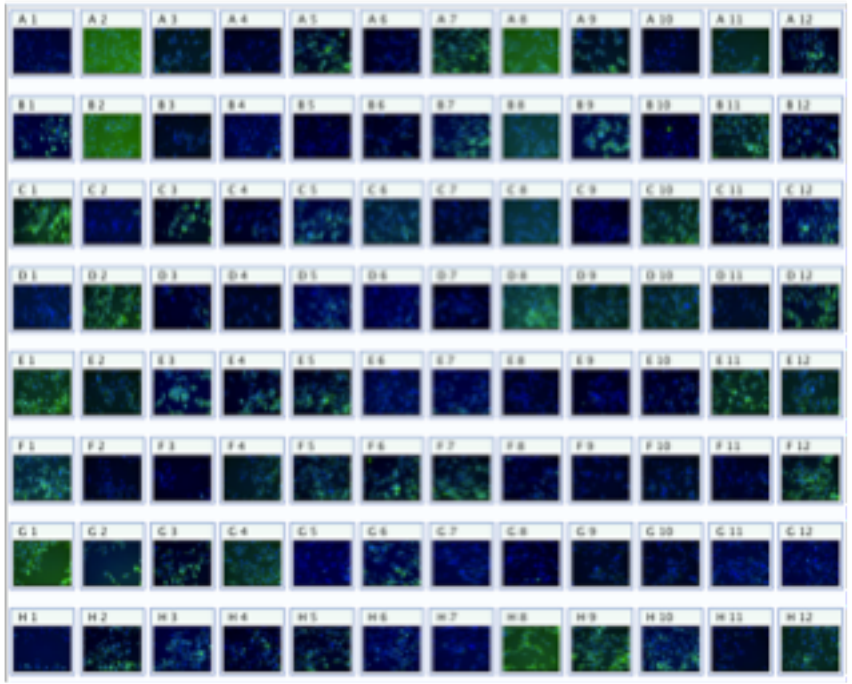

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https://docs.openmicroscopy.org/ome-model/5.5.7/developers/6d-7d-and-8d-storage.html