

The Open Microscopy Environment

11th Annual User's Meeting

University of Dundee

Jason Swedlow

The OME Consortium



Centre for Gene Regulation & Expression
College of Life Sciences, University of Dundee
Dundee, Scotland, UK



Talk Outline

- Thank you!
- This Meeting...
- The Problem
- Our Progress
- Funding...
- Future Priorities...

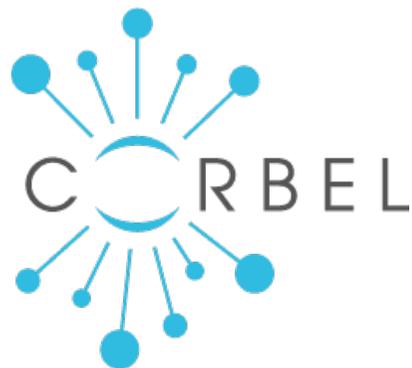
Thank you!!!



Wilma Woudenberg June Matthew

Thank you!!!

welcometrust



GLOBAL
BIOIMAGING
growing collaboration



Dundee OME Team & Glencoe Software



The OME Consortium



Paul
French



Gaudenz
Danuser



Ilan
Davis



Gianluigi
Zanetti



Peter
Sorger



Spencer
Shorte



Alvis
Brazma



Rafael
Carazo-Salas



Edouard
Bertrand

THIS MEETING.....

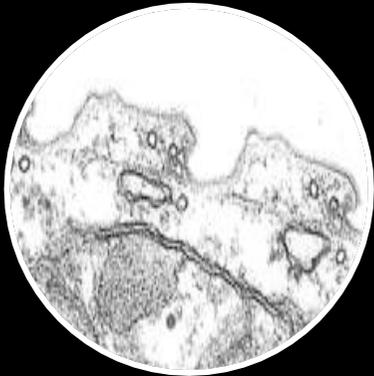
Meeting Purpose

11th Annual User's Mtg

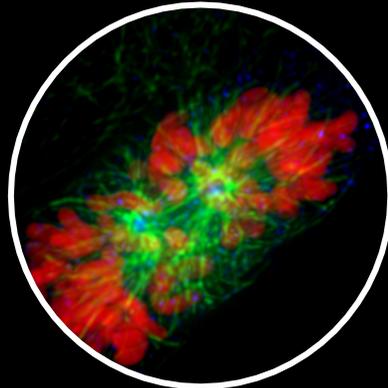
- Attendees
 - OME Consortium
 - Invited Speakers
 - Broad cross-section of users
- *Day 1: Presentations*
 - Lightning Talks
 - Project Overview
 - Invited Speakers
- *Day 2: Workshops & Demos*
- *Day 3: UnConference*
- Progress Report
- Future development priorities, funding & planning

THE PROBLEM

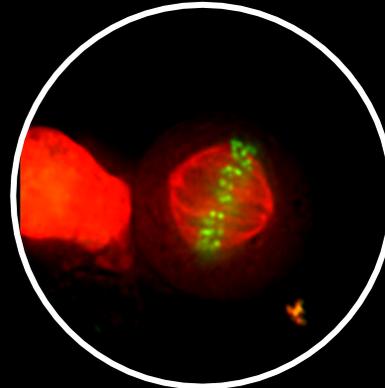
The Image Problem... is Ubiquitous



Organelles



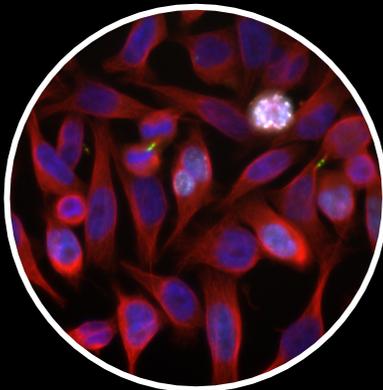
Cells



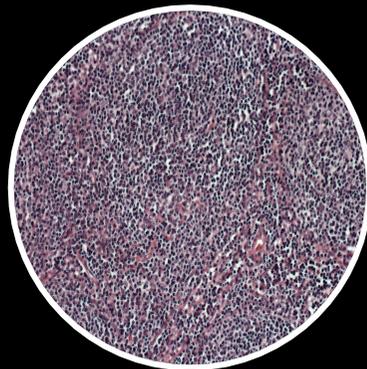
Dynamics



Physiology



Lead Discovery
Target Validation



Pathology



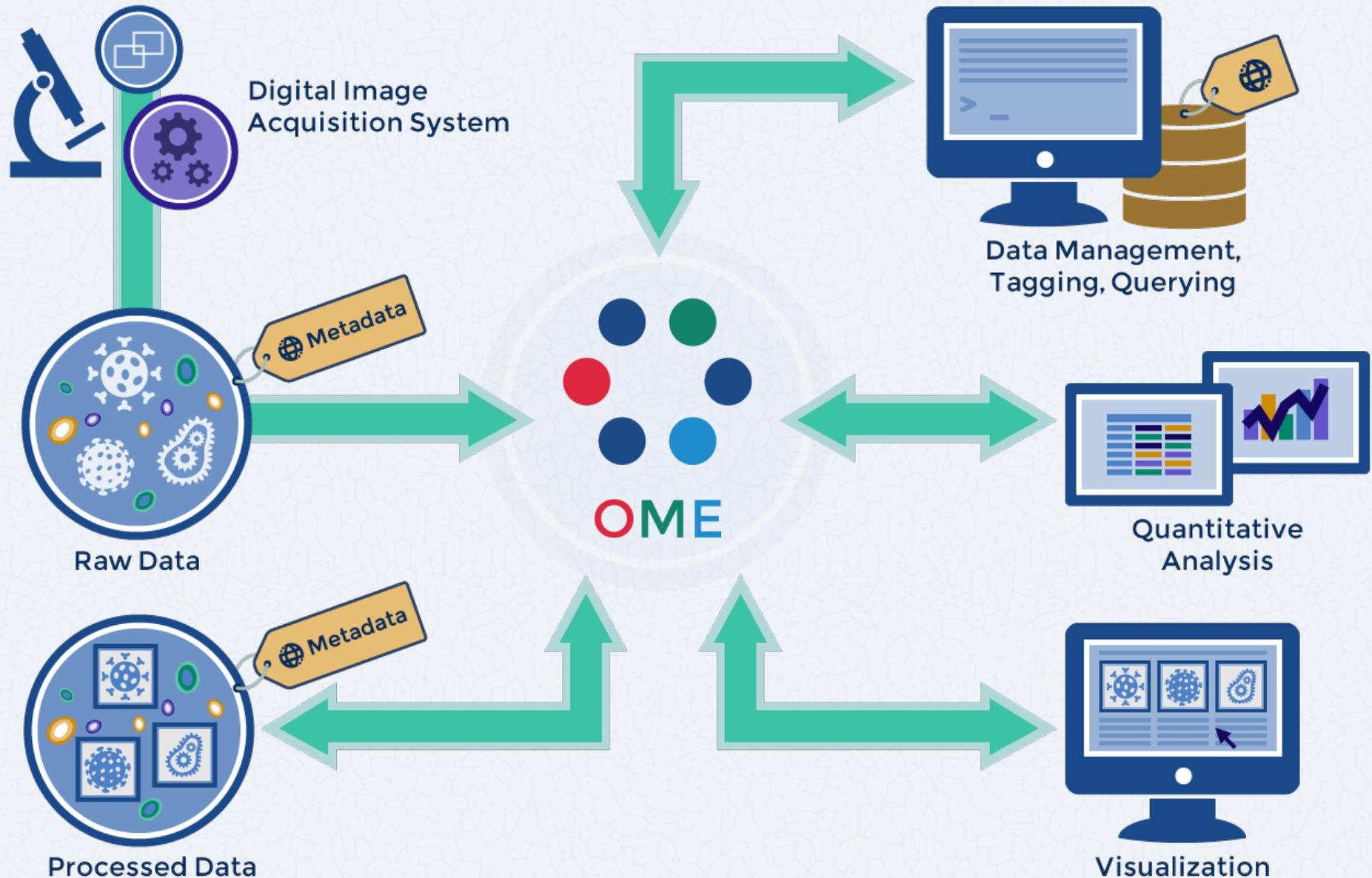
In Vivo

A pretty picture?

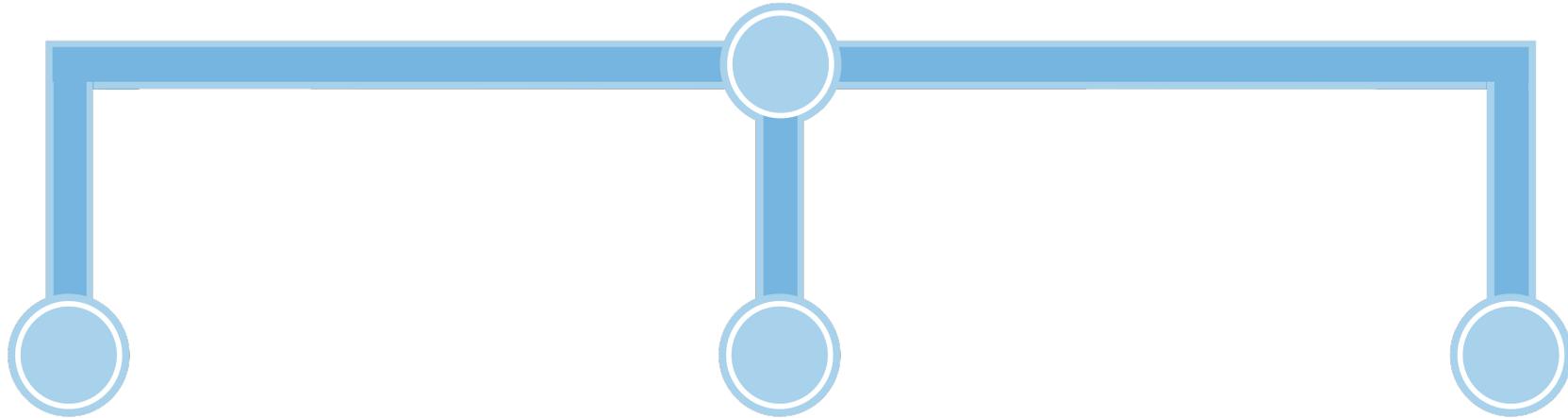
A measurement?

A resource?

...Towards Image Informatics



What We Do



OME-XML
OME-TIFF
OME FILES

Open
exchangeable
file formats
&
metadata

 **BIO-FORMATS**

Open
Proprietary File
Format
Translation

 **OMERO**

Open
Image Data
Management

OME File Formats

OME-XML ~ OME Data Model

OME-TIFF – TIFF file with OME-XML in the header

OME Files – C++-based reference implementation of the
OME Data Model

(i.e., definitive library for writing OME-XML, OME-TIFF, etc.)



Roger
Leigh



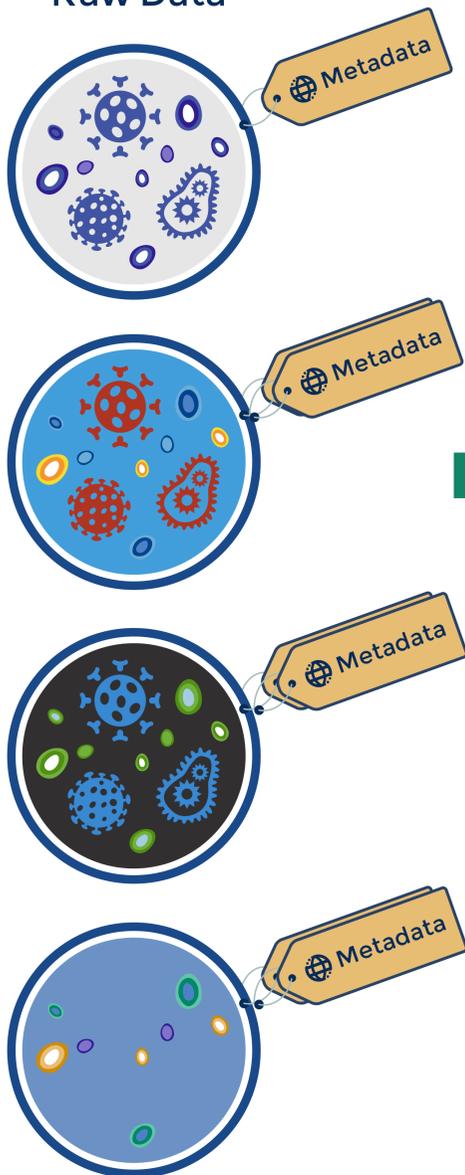
Sebastien
Besson



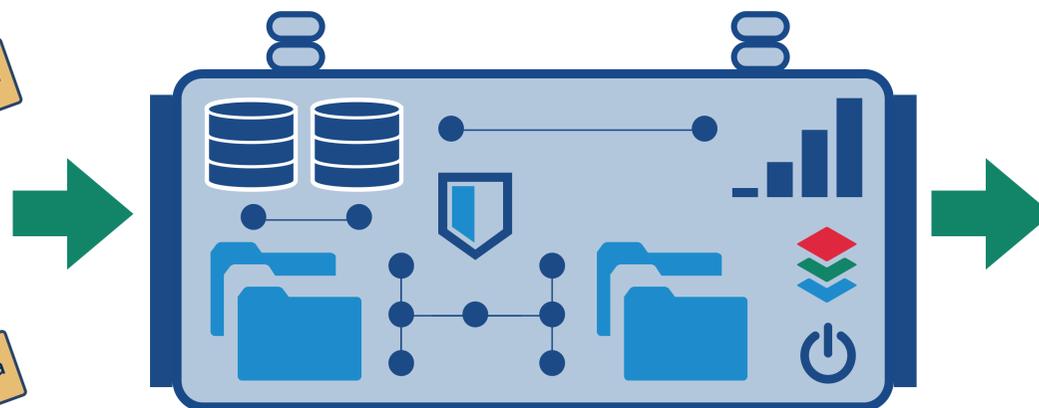
David
Gault

BIO-FORMATS: Proprietary File Conversion

Raw Data



BIO-FORMATS



600,000+ FILES



30,000+ DATASETS



5.7+ TERABYTES

Processed Data



ImageJ
Image Processing and Analysis in Java



MathWorks



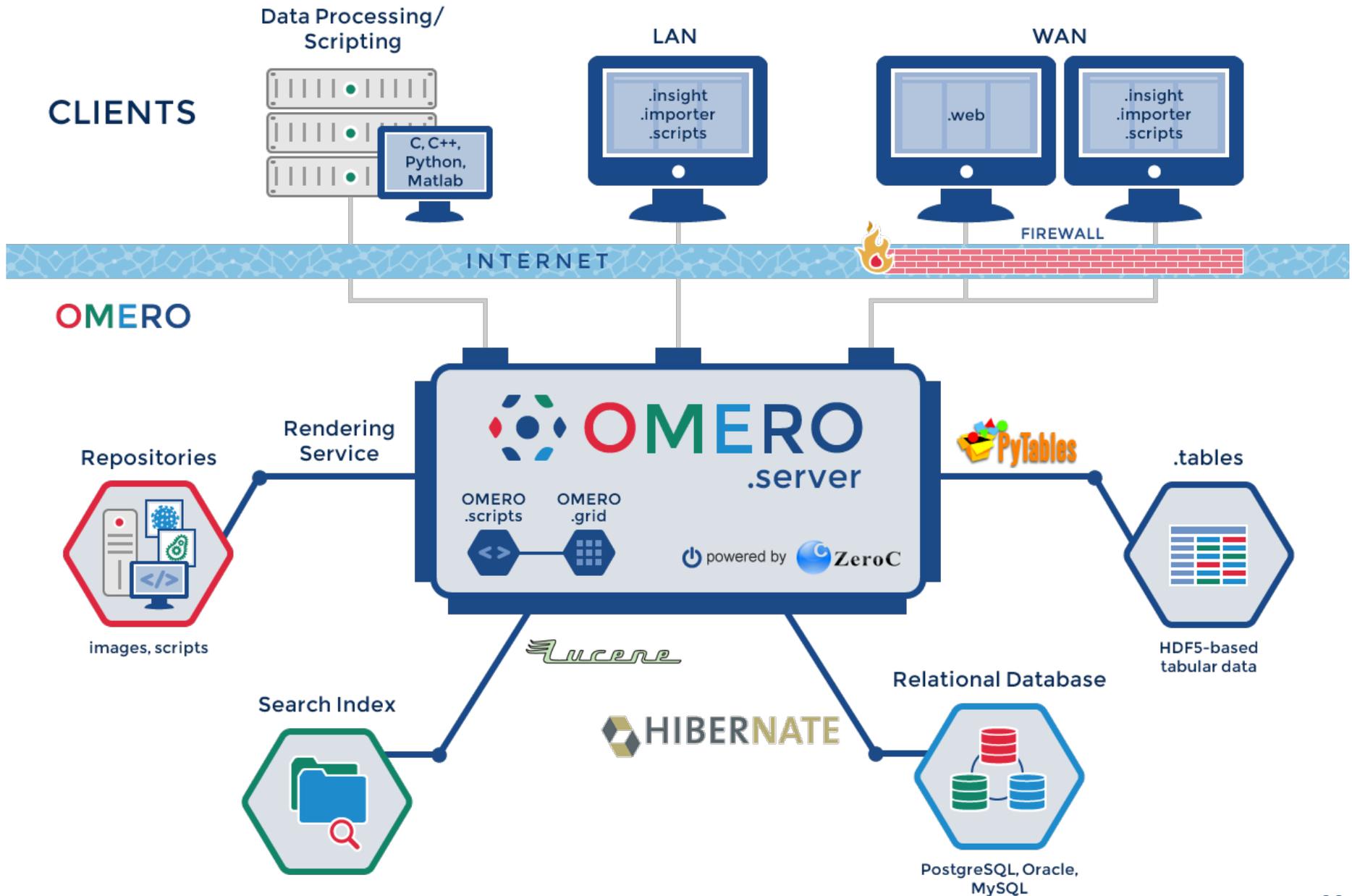
Columbus™



Your Software

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

The OMERO Platform





OMERO & BIO-FORMATS: OMERO.insight Java Client

The screenshot displays the OMERO Java Client interface. On the left, a 'Projects' tree shows a hierarchy of folders and images. The main workspace contains a grid of 11 image thumbnails. A detailed view of an image is shown on the right, with a 'Measurement Tool' window overlaid. The measurement tool window includes a table with the following data:

ROI	id	T	Z	Type	Text	Visible
	5662	[1,1]	[1,60]	<input type="checkbox"/>		<input checked="" type="checkbox"/>
	5663	[1,1]	[1,60]	<input type="checkbox"/>		<input checked="" type="checkbox"/>
	5664	[1,1]	[1,60]	<input type="checkbox"/>		<input checked="" type="checkbox"/>



OMERO & BIO-FORMATS: OMERO.web Client

The screenshot displays the OMERO.web Client interface. The top navigation bar includes 'OMERO', 'Data', and 'History'. The user 'Jason Swedlow' is logged in. The main area shows a list of datasets under 'Alexia Ferrand', with the selected dataset '101026-siCTL_LPM_M_total 11' containing multiple image files. The central viewer displays a microscopy image with a 'Viewing Options' panel on the left, including 'Normal' rendering, 'Max Intensity', 'Split Channel', 'Quality', and 'Zoom (%)' controls. The 'Rendering Details' panel shows channels for DAPI, FITC, RD-TR-PE, and CY-5. The 'Current Image' panel indicates 'Z: 32/60 | T: 1/1' and 'ROI Count: 3'. The right sidebar provides metadata for the image, including the file path, image ID, owner, acquisition date, dimensions, and channels. A comment by Alexia Ferrand is also visible.

Viewing Options

- Normal
- Max Intensity
- Split Channel
- Quality: Normal
- Zoom (%): 50
- Line Plot

Rendering Details

- Channels: DAPI, FITC, RD-TR-PE, CY-5
- Color: checked

Current Image

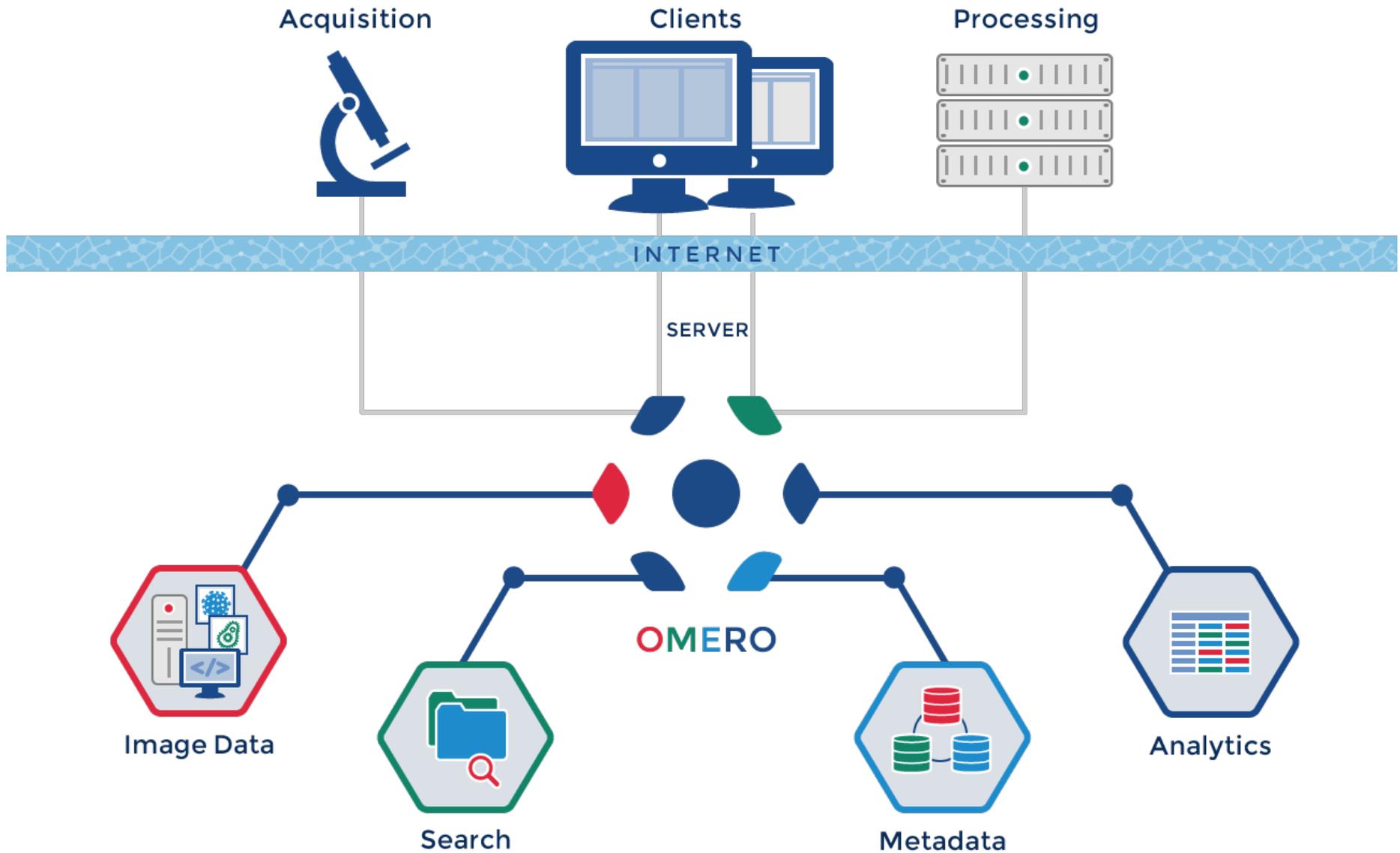
- Z: 32/60 | T: 1/1
- Image Information
- Image Link
- ROI Count: 3
- Show ROIs | Hide

Metadata

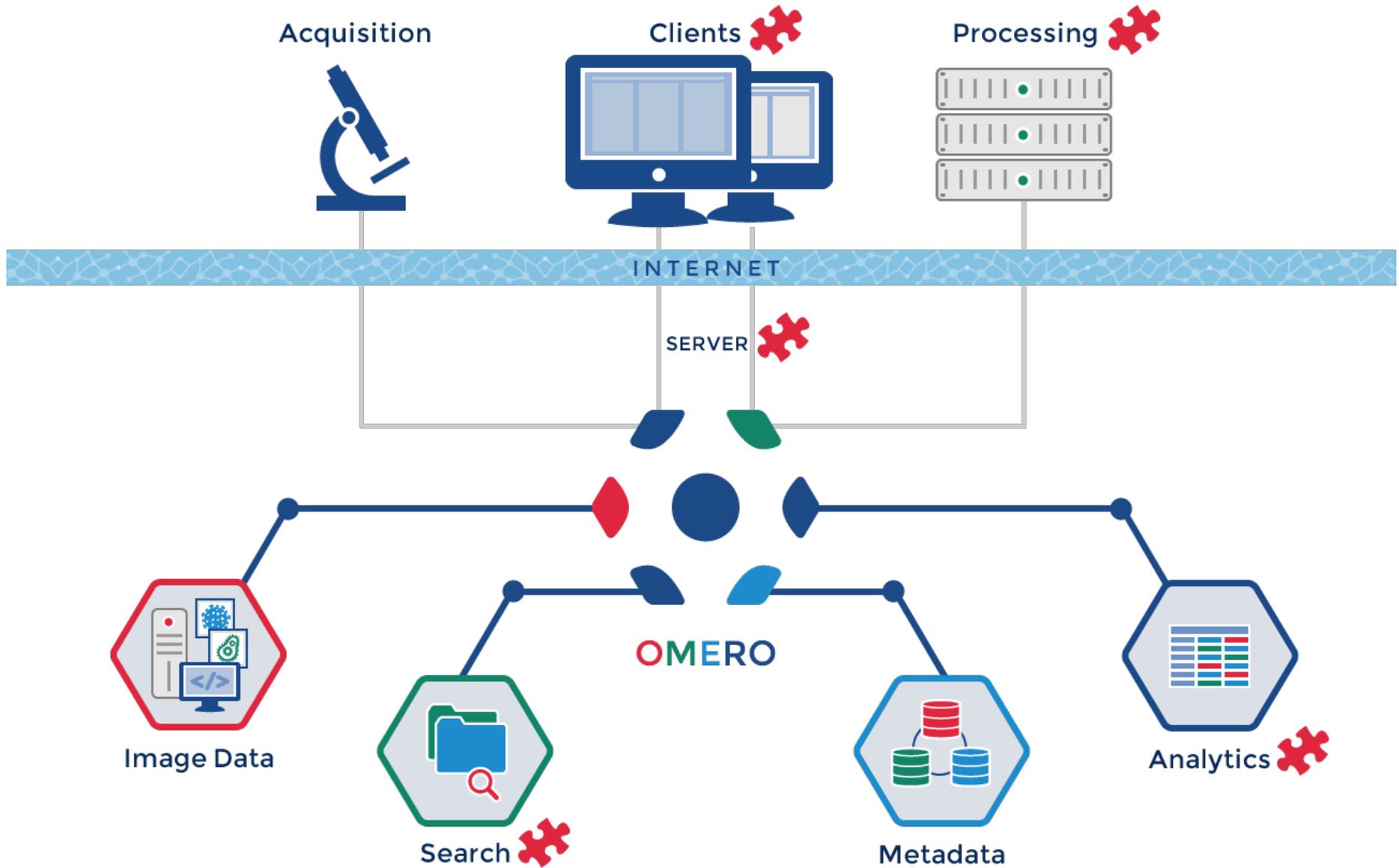
- General: Z:/aferrand/HP1/101026-siRNA/101026-siCTL-GFPMCAK_SKIP_ACA_02_07_R3D_D3D.dv
- IMAGE ID: 3840635
- Owner: Alexia Ferrand
- Acquisition Date: 2010-10-26 13:55:25
- Imported Date: 2010-10-26 14:06:41
- Dimensions (XY): 512 x 512
- Pixels Type: uint16
- Pixels Size (XYZ) (µm): 0.1001 x 0.1001 x 0.2000
- Z-sections/Timepoints: 60 x 1
- Channels: DAPI, FITC, RD-TR-PE, CY-5

Comment: Alexia Ferrand at 2010-11-09 14:16:33 for fig siCTL VS siMCAK

The OMERO Platform



The *Extensible* OMERO Platform



 Plugins Welcome



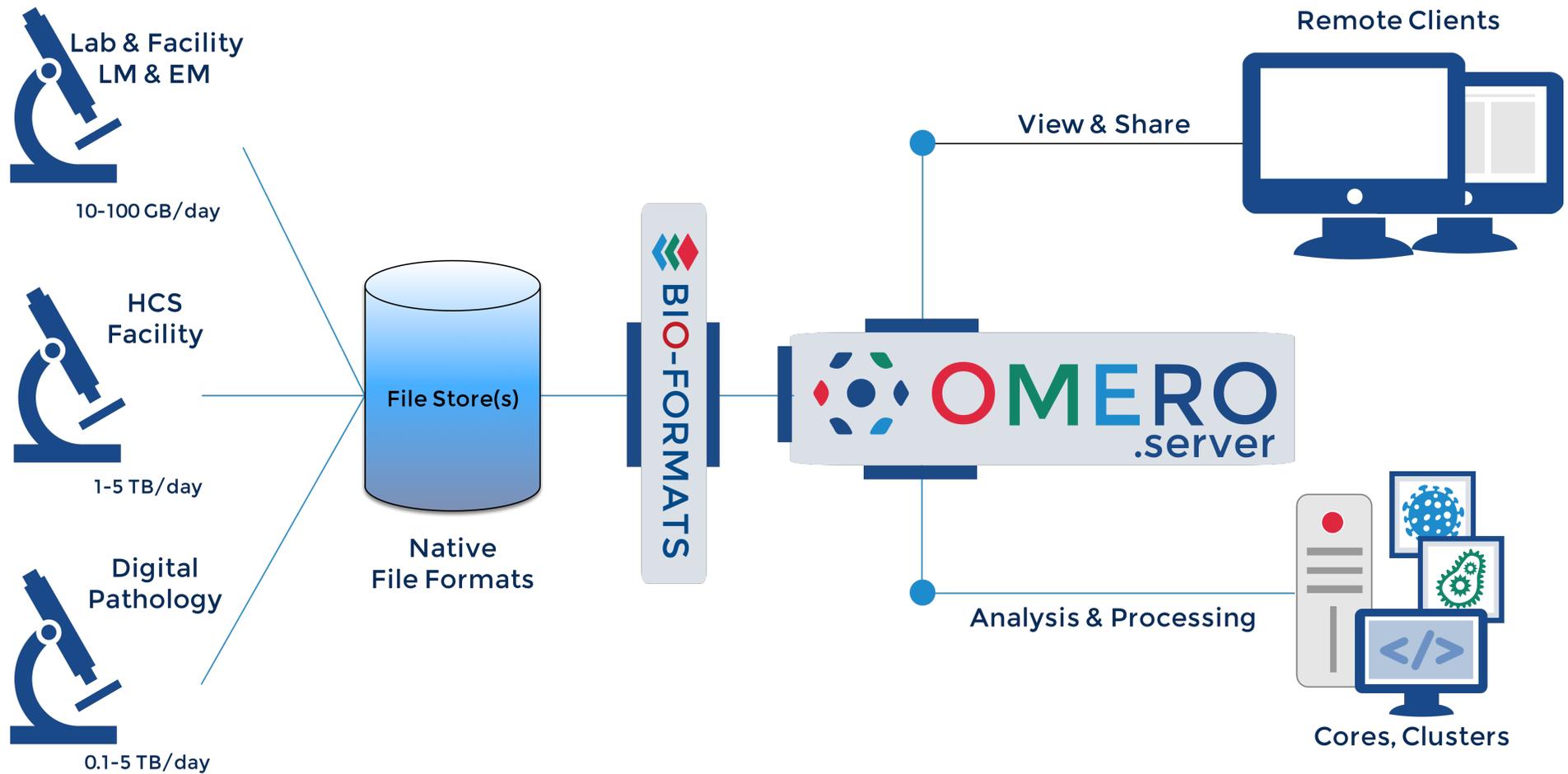
OMERO 5: Worldwide Impact



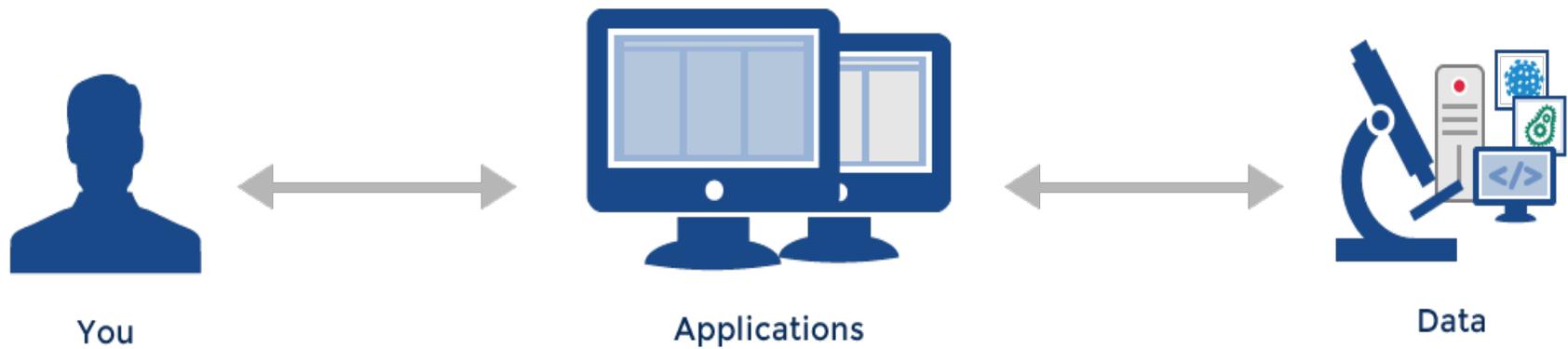
Unique IP Addresses Jan 1 – Dec 31 2015



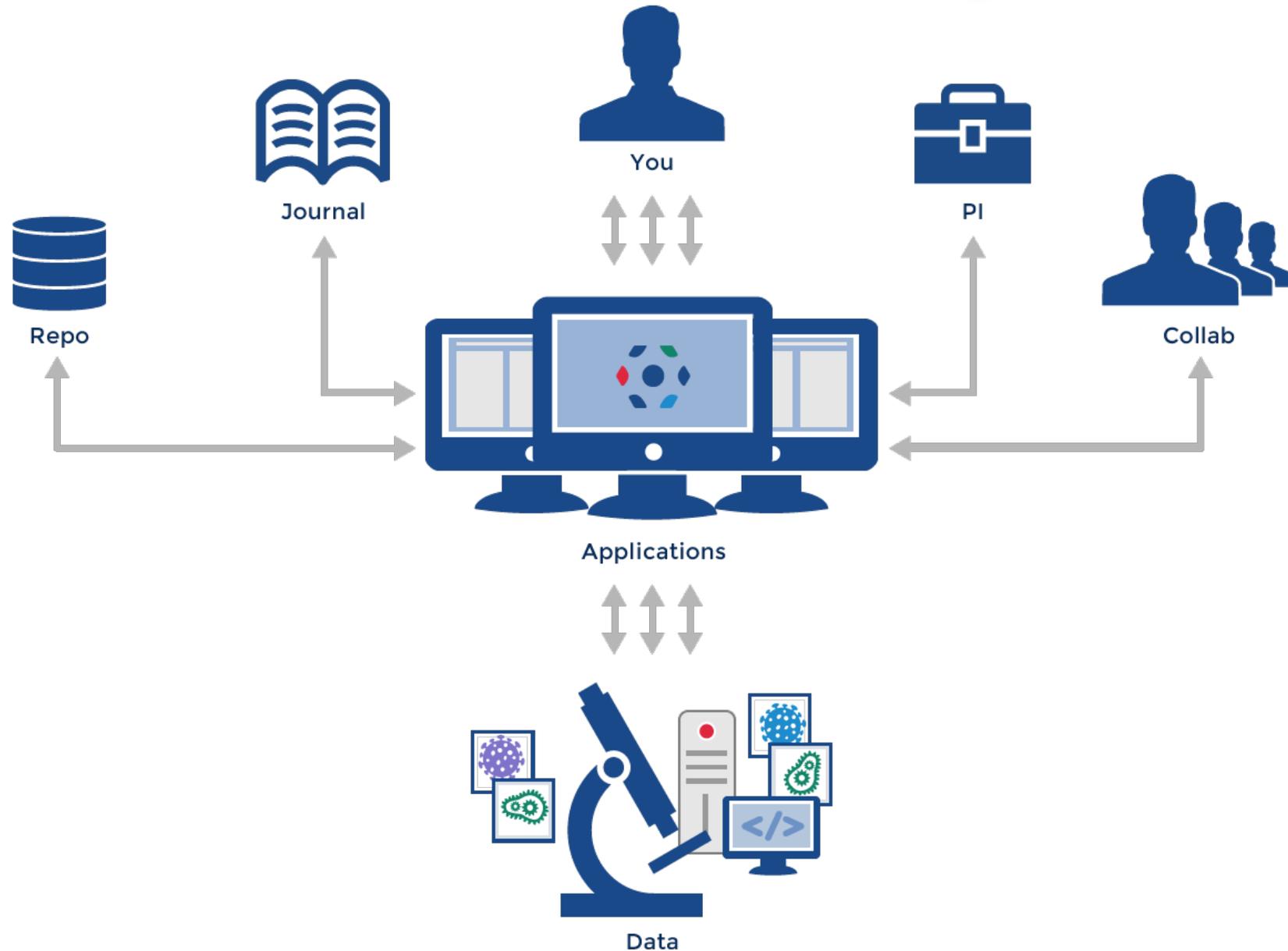
OMERO & Bio-Formats: Interfaces for Image Data Access



The Standard Paradigm



The "Scientific Data" Paradigm



INTEGRATING ANALYSIS...

Examples of Analysis Integration

FLIMfit- fluorescence lifetime fitting (Matlab)

WND-CHRM-- weighted nearest neighbor machine learning (Python)

ThunderSTORM and PALMSiever- Localisation SRM (ImageJ, Matlab)

OMERO2CV- LSFM Multi-View Reconstruction (C++, OpenCV, ITK)

uTrack- Globally optimised object tracking (Matlab)

CellProfiler- HCS segmentation and features (Python)

mTools- Otsu, basic segmentation (Matlab)

ImageJ/Fiji, Icy- Pluggable, desktop Image processing tools (Java)

Coumbus Acapella[®]-- commercial Big Data processing...

→ See Webinars at glencoesoftware.com for Matlab, Jupyter examples

HETEROGENEOUS METADATA ...

Metadata Support in OMERO

Case, Treatment, Conditions, Experiments... (K-Vs)

Files- DOC, PDF, XLS, (Blobs)

Image Acquisition (Bio-Formats)

Large Tables... (HDF5)

Hierarchies... (Folders, Regions, Ontologies...)*

** See blog.openmicroscopy.org for work on "Folders"*

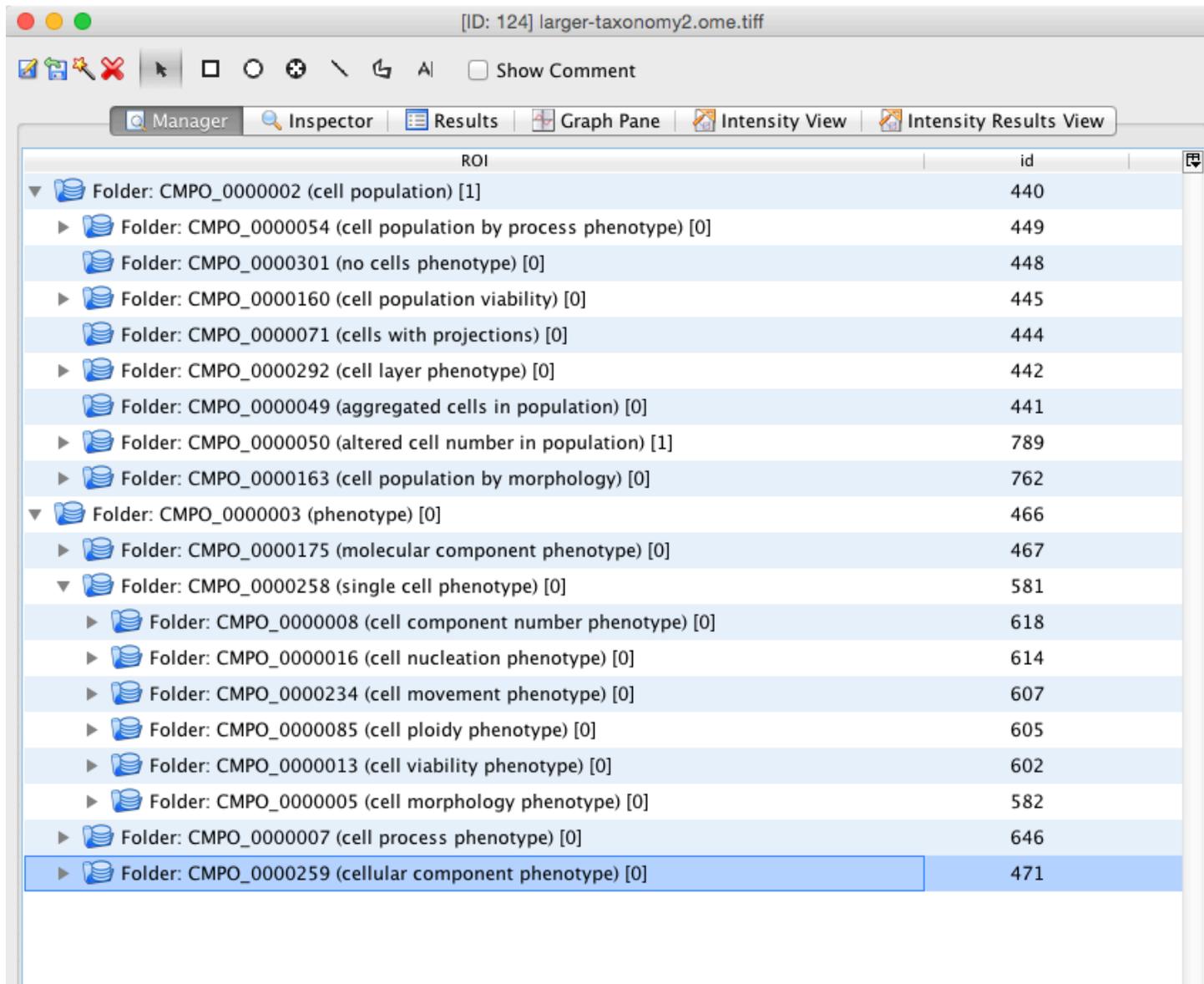
OME 5.1: Map Annotations

The screenshot displays the OME 5.1 interface for a specific image. The 'Annotations' section is highlighted, showing a table of key-value pairs. The table is ordered and contains non-unique keys. A blue arrow points to the table from the text 'Ordered, non-unique, key-value pairs'.

Key	Value	
Temperature	37.0	x
Cell Line	HT-29	x
Concentration - Sodium	150.0	x
Concentration - Potassium	4.3	x
Add key	Add value	
Concentration - Potassium	4.3	
Concentration - Potassium	4.8	
Antibodies	Sheep	

Ordered, non-unique, key-value pairs

Folders: Regions, Ontologies, ...



ROI	id
▼ Folder: CMPO_0000002 (cell population) [1]	440
▶ Folder: CMPO_0000054 (cell population by process phenotype) [0]	449
Folder: CMPO_0000301 (no cells phenotype) [0]	448
▶ Folder: CMPO_0000160 (cell population viability) [0]	445
Folder: CMPO_0000071 (cells with projections) [0]	444
▶ Folder: CMPO_0000292 (cell layer phenotype) [0]	442
Folder: CMPO_0000049 (aggregated cells in population) [0]	441
▶ Folder: CMPO_0000050 (altered cell number in population) [1]	789
▶ Folder: CMPO_0000163 (cell population by morphology) [0]	762
▼ Folder: CMPO_0000003 (phenotype) [0]	466
▶ Folder: CMPO_0000175 (molecular component phenotype) [0]	467
▼ Folder: CMPO_0000258 (single cell phenotype) [0]	581
▶ Folder: CMPO_0000008 (cell component number phenotype) [0]	618
▶ Folder: CMPO_0000016 (cell nucleation phenotype) [0]	614
▶ Folder: CMPO_0000234 (cell movement phenotype) [0]	607
▶ Folder: CMPO_0000085 (cell ploidy phenotype) [0]	605
▶ Folder: CMPO_0000013 (cell viability phenotype) [0]	602
▶ Folder: CMPO_0000005 (cell morphology phenotype) [0]	582
▶ Folder: CMPO_0000007 (cell process phenotype) [0]	646
▶ Folder: CMPO_0000259 (cellular component phenotype) [0]	471

Google: OMERO Folders, coming in OMERO 5.3, Summer 2016

DATA SHARING...

Security Model

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

OMERO.figure

OMERO.figure Demo 2

OMERO File Edit Save Add Image Delete Export PDF

Save Figure to OMERO Prophase Metaphase Anaphase

Info Preview Labels

Scalebar Pixel Size: NOT SET
10 μm Show

Add Labels
Anaphase 18 Add

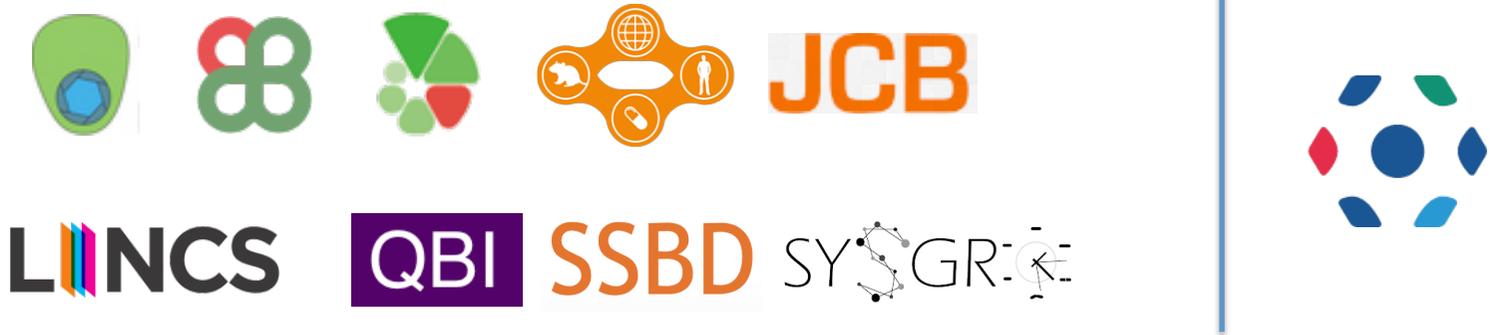
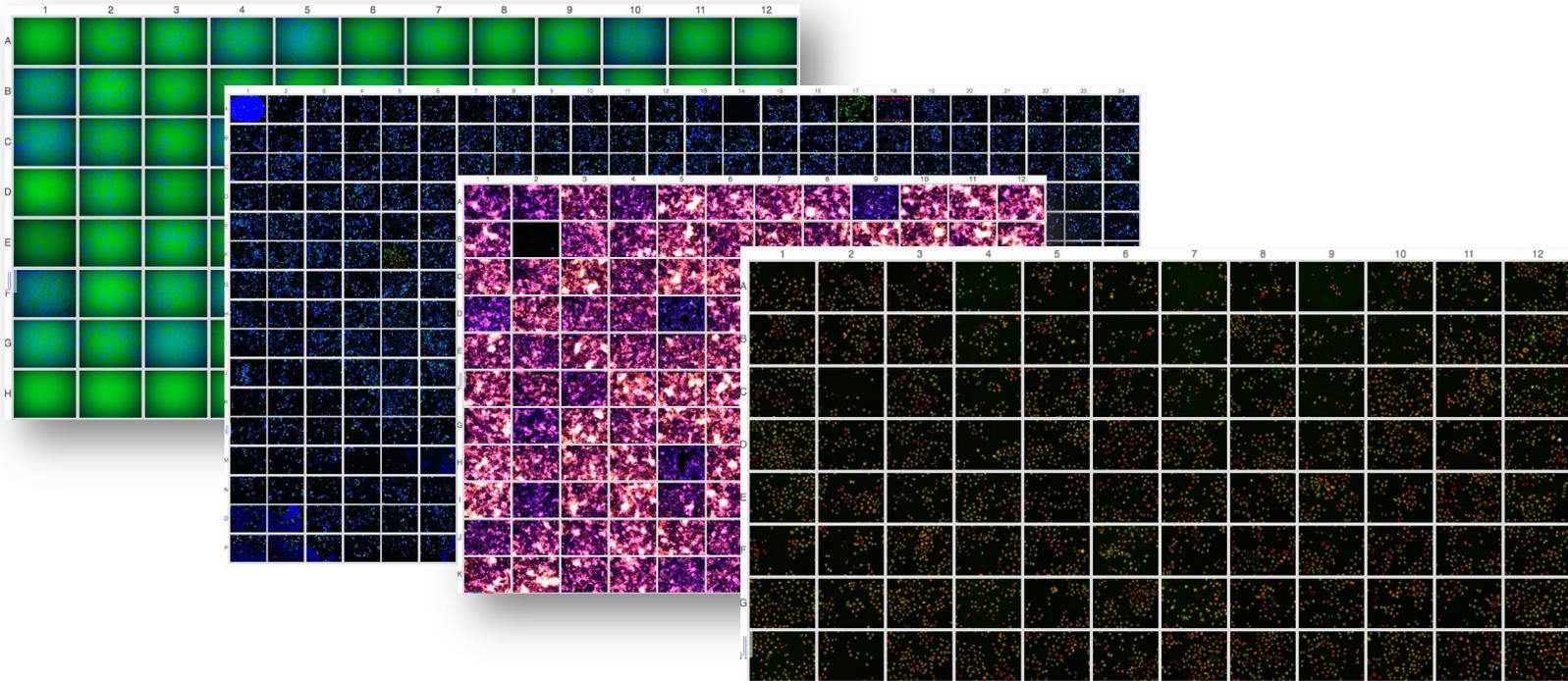
Edit Labels

Prophase	18				X
Metaphase	18				X
Anaphase	18				X

:55 CC HD YouTube

Will Moore (Google: "OMERO figure")

Data Sharing with OMERO

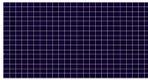


A Vision...

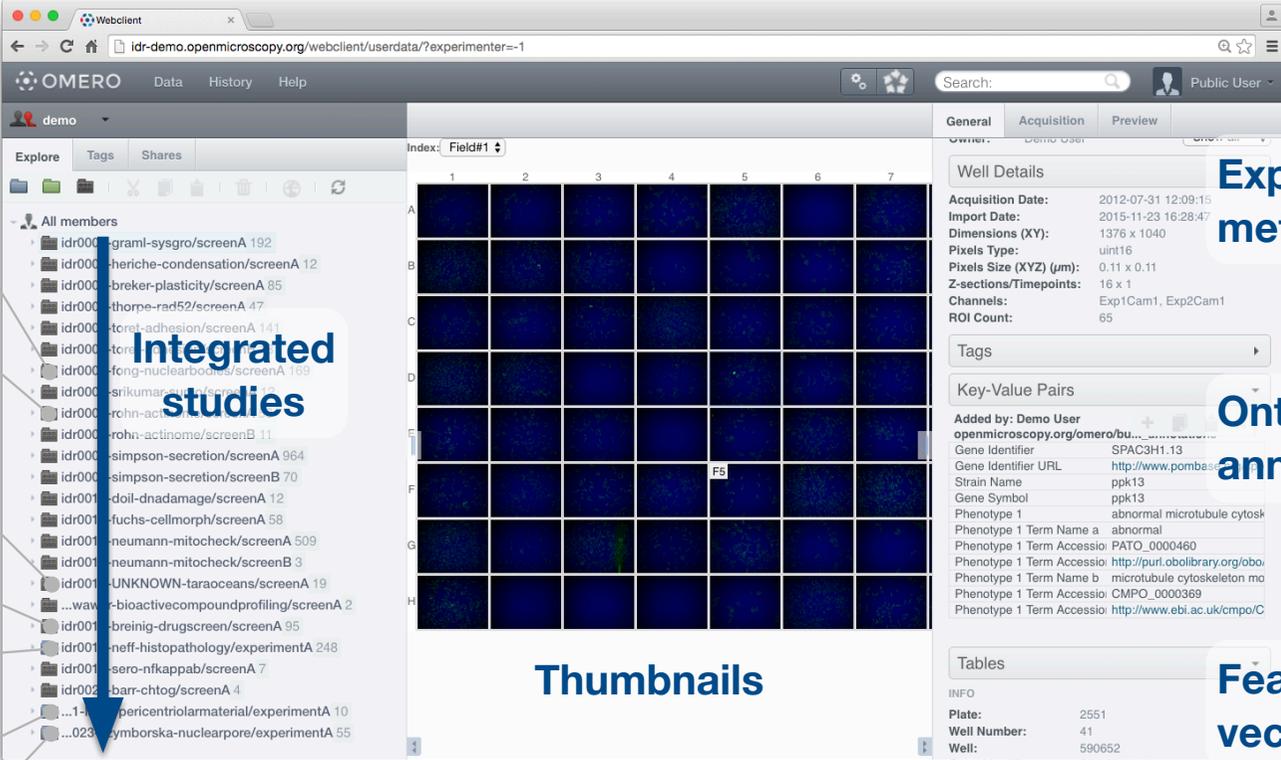

Gene Product
Targeting HCS


Genetic HCS


Geographic
HCS


Chemical HCS


Histopathology



The screenshot shows the OMERO webclient interface. On the left is a file explorer with a tree view of experiments. The main area displays a grid of image thumbnails labeled A through H and 1 through 7. On the right, a metadata panel shows details for a selected well, including acquisition and import dates, dimensions, and various tags and key-value pairs.

Experimental
metadata

Ontological
annotations

Feature
vectors



Josh
Moore



Eleanor
Williams



Simon
Li



Simone
Leo



Gus
Ferguson



Gabriella
Rustici



Anatole
Chessel



TAKING CARE OF USERS

OME Help

OMERO User Help - Home Page

Current OMERO Version: 5.2.4



User Help

[User Help Home Page](#)

▼ Quickstart User Guides

[OMERO.insight](#)

[OMERO.web](#)

[OMERO.figure](#)

[Using ImageJ with OMERO](#)

[Try the OMERO Demo Server](#)

▶ Data Workflow User Guides

▶ More Workflow User Guides

▶ Other OMERO Applications

▼ More

[OMERO for Facility Managers](#)

[Troubleshooting](#)

[Training Course Material](#)

[Previous Versions](#)

[Contact OME](#)

[Main OME Website](#)

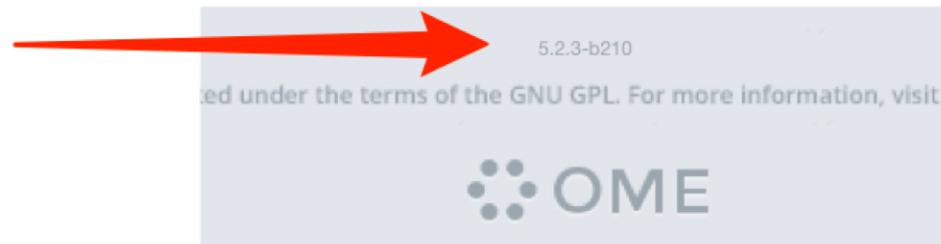
These pages contain the User Help for applications which can connect to an OMERO server or use OMERO plugins.

The User Guides for the current versions are listed in the main menu, for all OMERO applications, including OMERO.insight, OMERO.web, OMERO.figure and OMERO in ImageJ and Fiji.

The [Guides for Previous Versions](#) page has links to archives of older versions.

The [Training Course Material](#) page contains links to material for printing out and using in training sessions, ZIP archives of the PDFs for all the current versions, customised versions of some of the Guides and other resources such as Omnigraffle® and Word® files.

The current release version of OMERO.insight is 5.2.4. You can tell what version of OMERO you are using by looking at the login screen, or selecting **About OMERO.insight** from the Help menu in OMERO.insight.



All the Version 5 material on the User Help website applies to both version 5.1.4 and version 5.2, with the exception of the new features mentioned below, but note that version 5.1 is now unsupported and will not be updated.

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OME QA, Docs & Outreach



Welcome, Jason! [Logout](#)
Last login: 2016 05 31 00:48:00

[Home](#) | [Validator](#) | [Feedback](#) | [Send files](#) | [Statistics](#) | [Registry](#) | [Demo](#)

Feedback

Status: Date: Text: User/email:

Filter tips:

- **Date:** Pick a date from the calendar or type in format "**yy-mm-dd**". Calendar appears while you click the field. Filtered records are from the picked date up till now.
- **Text:** Type the string that will be searched in: version, comment, error or selected file.
- **User email:** Type a username, first or last name or email address.

[All](#) | [Importer Comment](#) | [Importer Bug](#) | [Insight Comment](#) | [Insight Bug](#) | [Test Engine Bug](#) | [Web Bug](#) | [QA Bug](#) | [CLI Bug](#) |

ID	Status	User/email	Type	Created	Selected file	Comment	Error
17212	new	lando.wark@g...	Insight 5.2.3-ice3	2016 05 30	-	Trying to view original metada...	java.lang.Exception: omer...
17210	new	ufana2002@gm...	QA	2016 05 29	-	-	-
17195	new	shaun.hare@n...	QA	2016 05 23	-	-	-



Petr
Walczysko

Gus
Ferguson

Helen
Flynn

Balaji
Ramalingam

Colin
Blackburn

OME Senior Management



Jason Swedlow

Jean-Marie Burel

Sebastien Besson

Josh Moore

Chris Allan

REVIEW OF 2015/2016

A Year of Work in One Slide

OME Data Model

- Folders (ROIs, etc)

OME Files C++

- Full release, 2015 Data Model

Bio-Formats

- File format fixes, doc updates, OMERO decoupling, prep for 5.3.x

OMERO

- Web and graph improvements, prep for 5.3.x

IDR

- Data ingest, Prototype releases, migration to EMBL Embassy

GOING FORWARD

Our Funding Proposals (Status)

Bio-Formats

- Native Application Support
- Stateful
- Object Stores
- Experimental and Analytic Metadata Resources

OMERO

- Extended Metadata (tables, graphs, ontologies...)
- IDR Data Publication (part funded)
- Federation
- Modernizing Client Framework
- Rendering Engine Update
- Permissions and Search Update
- Publication

Consortium

- Outreach and Training (funded)

Critiques of OME

Funder Feedback

- Lack of clarity over the future directions, long-term plans and sustainable model.
- Integrate data processing tools into OMERO as opposed to supporting the interoperability of existing tools/data formats
- Usability in terms of installation– when will OMERO be easily accessible to any small lab?
- Form an ISO organization
- Be more like DICOM
- Not high enough priority

Some words to think about...

- New Modalities (MS, Raman, X-ray, etc.)
- Multi-modal/Correlative
- Federation:
 - SSO
 - Multiple data sources
- Import/Export
- Ontologies
- Gateway
- REST API
- C++ API
- Client Architecture
- Data Publication
- “Cloud”
- “Scale”
- Usability
- Sustainability
- ...

THE OME CONSORTIUM

Focus on Inclusion and Contribution



- Consortium formed as part of the 2011 Wellcome Trust Strategic Award
- Now more open— anyone who is investing in working with OME tools and making contributions
- Level of interaction varies

Partnership as a Strategy

Project Philosophy

→ Build technology in the context of critical scientific problems

An Unfortunate Trend

→ OME as a Solution Provider

Key Strategic Path:

→ OME as an R&D Partner, to solve major challenges in
accessing and using scientific data

→ Going beyond Github, to drive the synergies across all partners

OME Consortium

Dundee – Jason Swedlow, Sebastian Besson, Colin Blackburn, Jean-Marie Burel, Mark Carroll, Gus Ferguson, Helen Flynn, Kenny Gillen, Roger Leigh, , Simone Leo, Simon Li, Dominik Lindner, June Matthew, Josh Moore, Will Moore, Balaji Ramalingam, Gabriella Rustici, Aleksandra Tarkowska, Petr Walczysko, Eleanor Williams, Wilma Woudenberg
University of Wisconsin, Madison (LOCI) - Kevin Eliceiri, Curtis Rueden, Mark Hiner
UT Southwestern – Gaudenz Danuser

Oxford – Ilan Davis, David Pinto

Cambridge – Rafael Carazo-Salas, Bálint Antal, Anatole Chessel

CRS4 - Gianluigi Zanetti, Gianmauro Cucurru, Luca Lianas

Edinburgh – Richard Baldock, Mark Arends, Michael Cheeseman

Carnegie-Mellon – Robert Murphy, BK Cho, Ivan Cao-Berg

Imperial – Paul French, Chris Dunsby, Ian Munro, Yuriy Alexandrov

NIA, NIH – Ilya Goldberg, Chris Coletta

Pasteur – Spencer Shorte, SebaAnne Daenckart

HMS – Peter Sorger, Douglas Russell, Jay Copeland

MRI – Edouard Bertrand, Andrea Falconi, Julio Langerak

EMBL-EBI – Gerard Kleywegt, Ardan Patwardhan, Ingvar Lagerstedt, Alvis Brazma, Ugis Sarkans

Glencoe Software – Chris Allan, Joshua Ballanco, Andreas Knab, Melissa Linkert, Chris MacLeod, Josh Moore, Emil Rozbicki, Liza Unson, Wilma Woudenberg

