

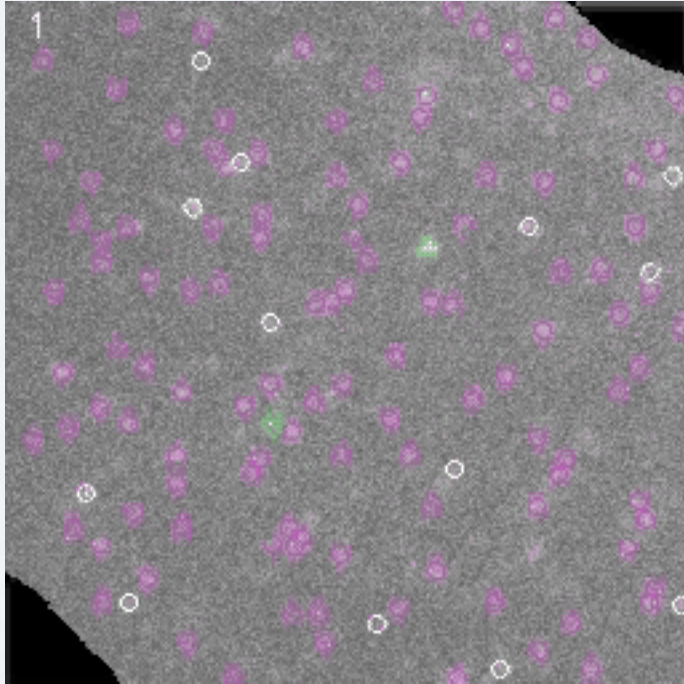


# Tracking with OMEERO

Sébastien Besson / Gaudenz Danuser  
OME / Harvard Medical School

8th Annual OME Users Meeting  
June 24, 2013 - Institut Pasteur

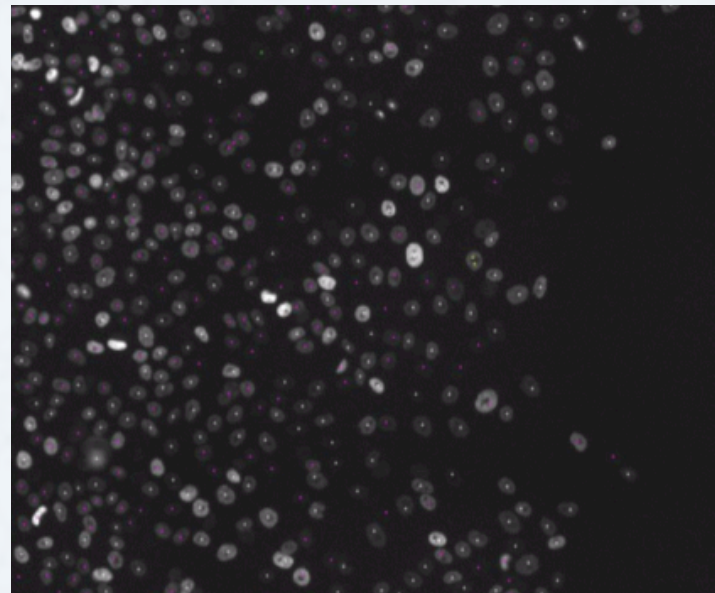
# Tracking sub-cellular objects



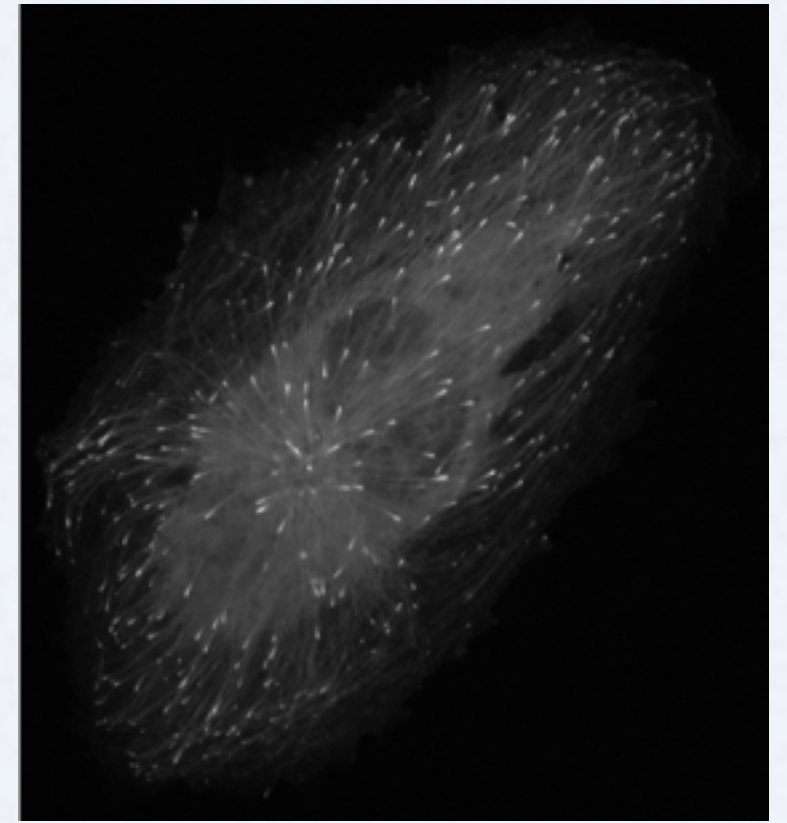
Jaqaman et al. Cell 2011

**Single  
particles**

**Histone-marked  
nuclei**



Ng et al. JCB 2012



Applegate et al. JSB 2011

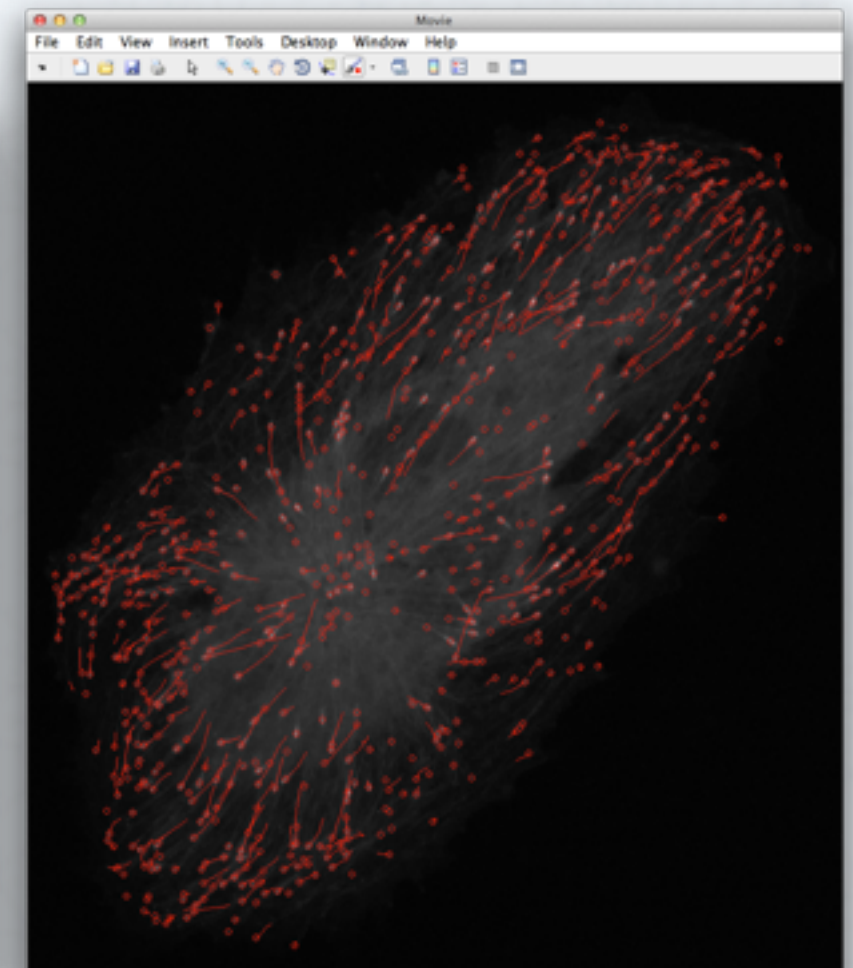
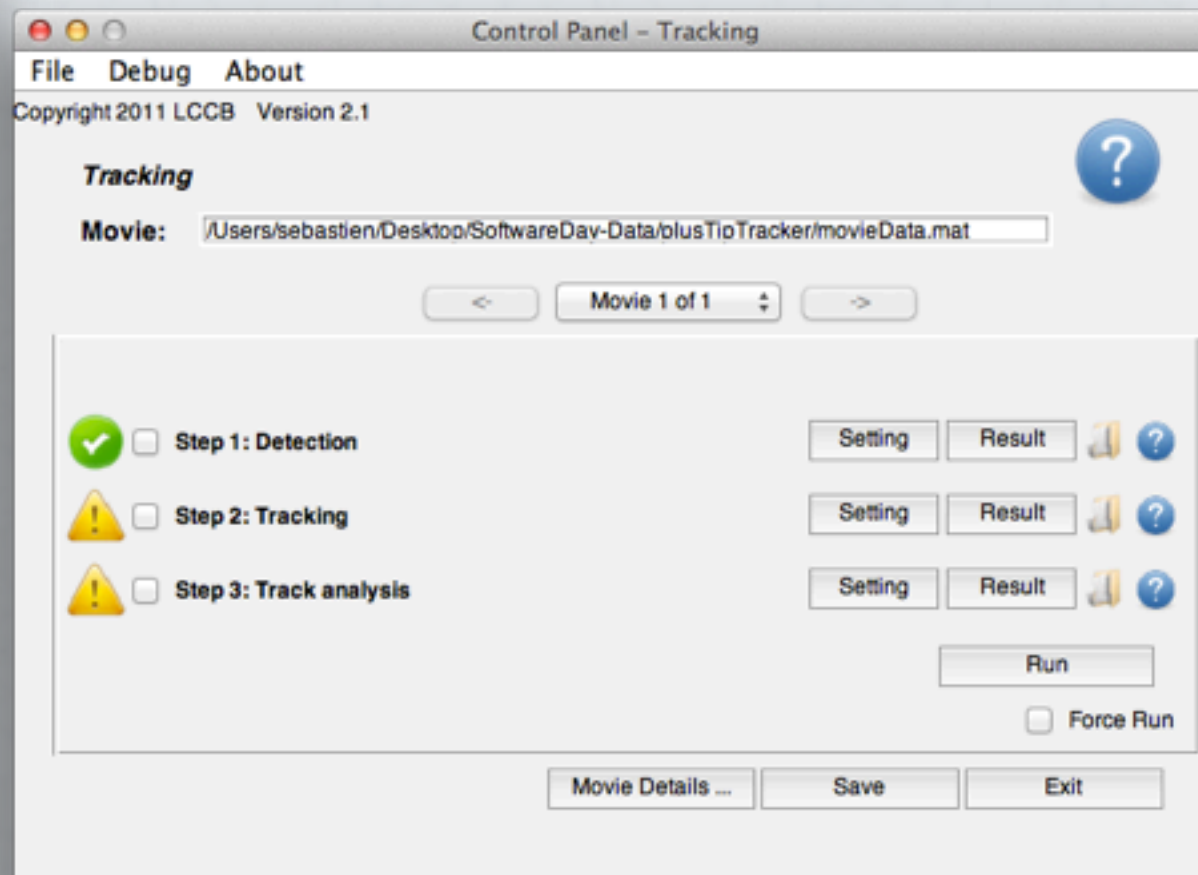
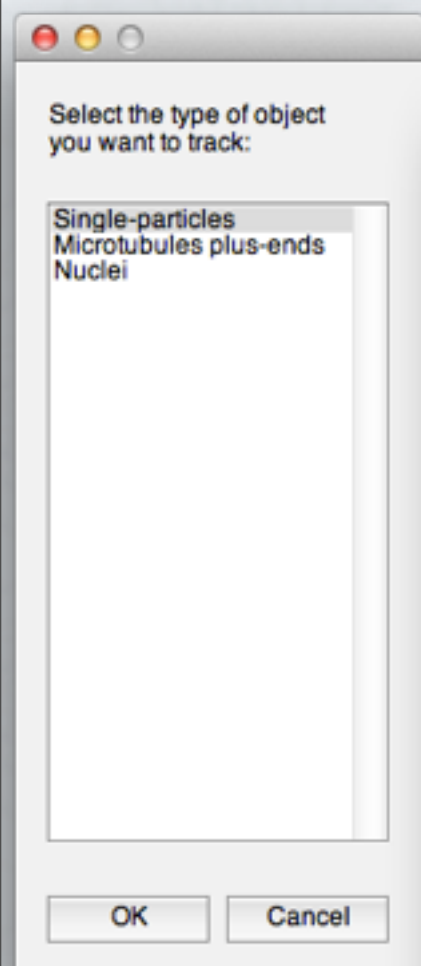
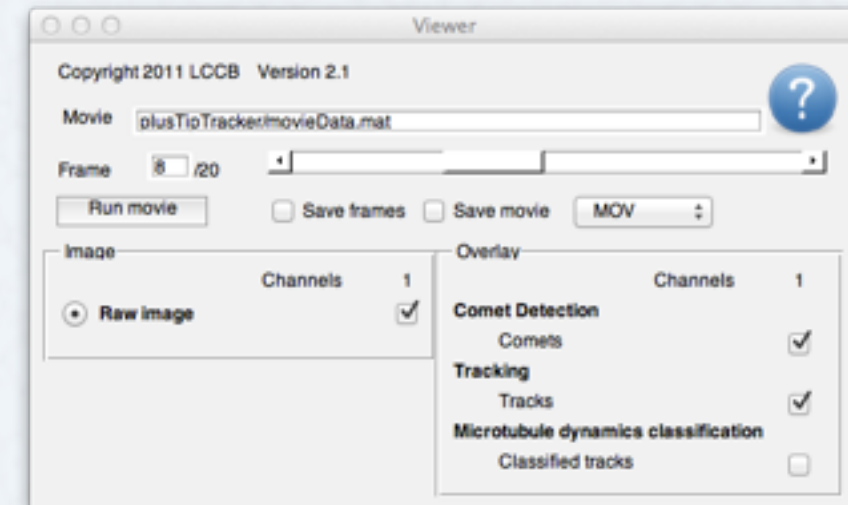
**Microtubule  
plus-ends**

Tracking framework (Jaqaman et al. Nature Methods 2008)  
Object detection and object tracking including gap closing (particle disappearance), merging (e.g. vesicle fuse) and splitting (e.g. mitotic events)

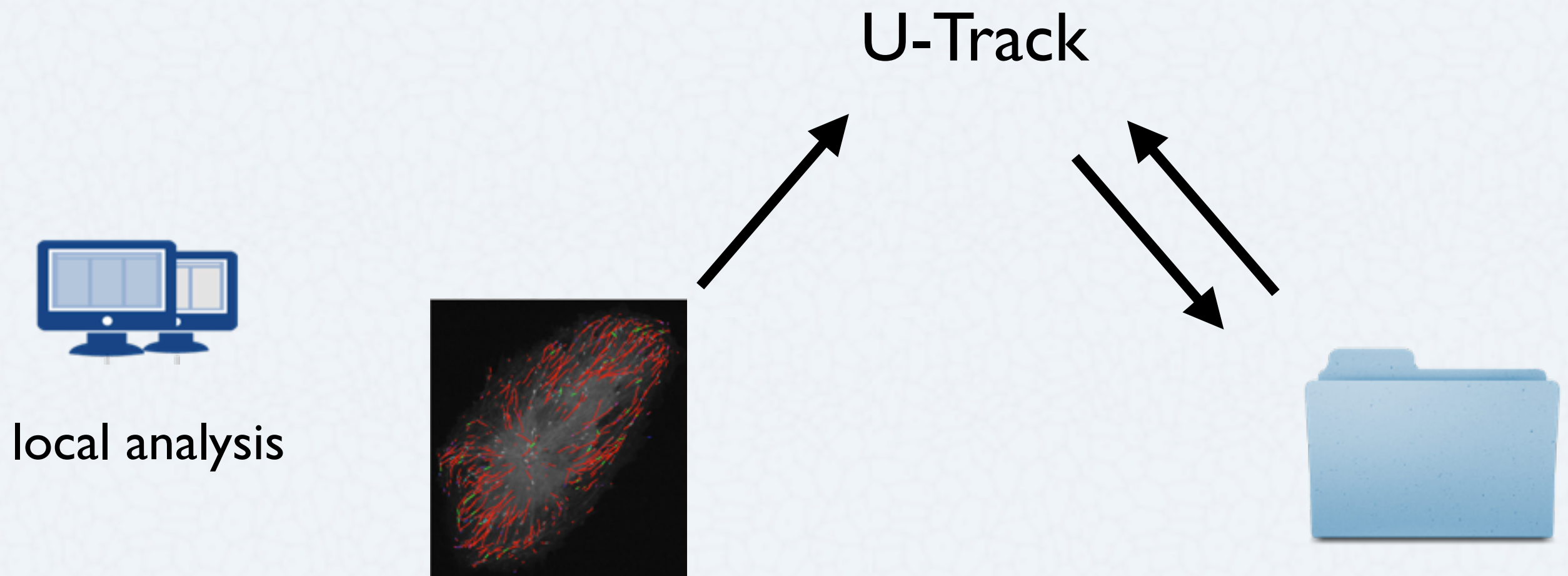


# Matlab tracking tool

- U-Track: <http://lccb.hms.harvard.edu/software.html>
- Object-based tracker initialization
- Workflow management/batch analysis
- Tracks/labelled track visualization



# Integration with OMERO





# Integration with OMERO



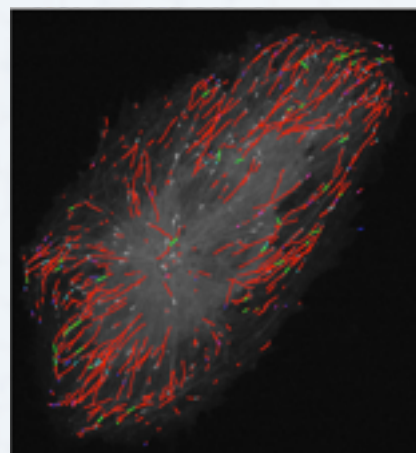
Image

client-side analysis



local analysis

U-Track



# Integration with OMERO



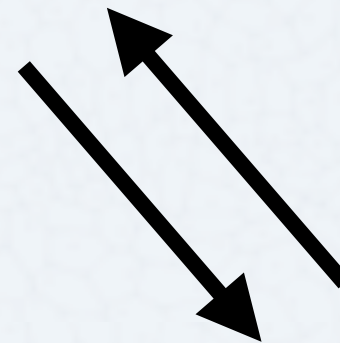
client-side analysis

OMERO.matlab

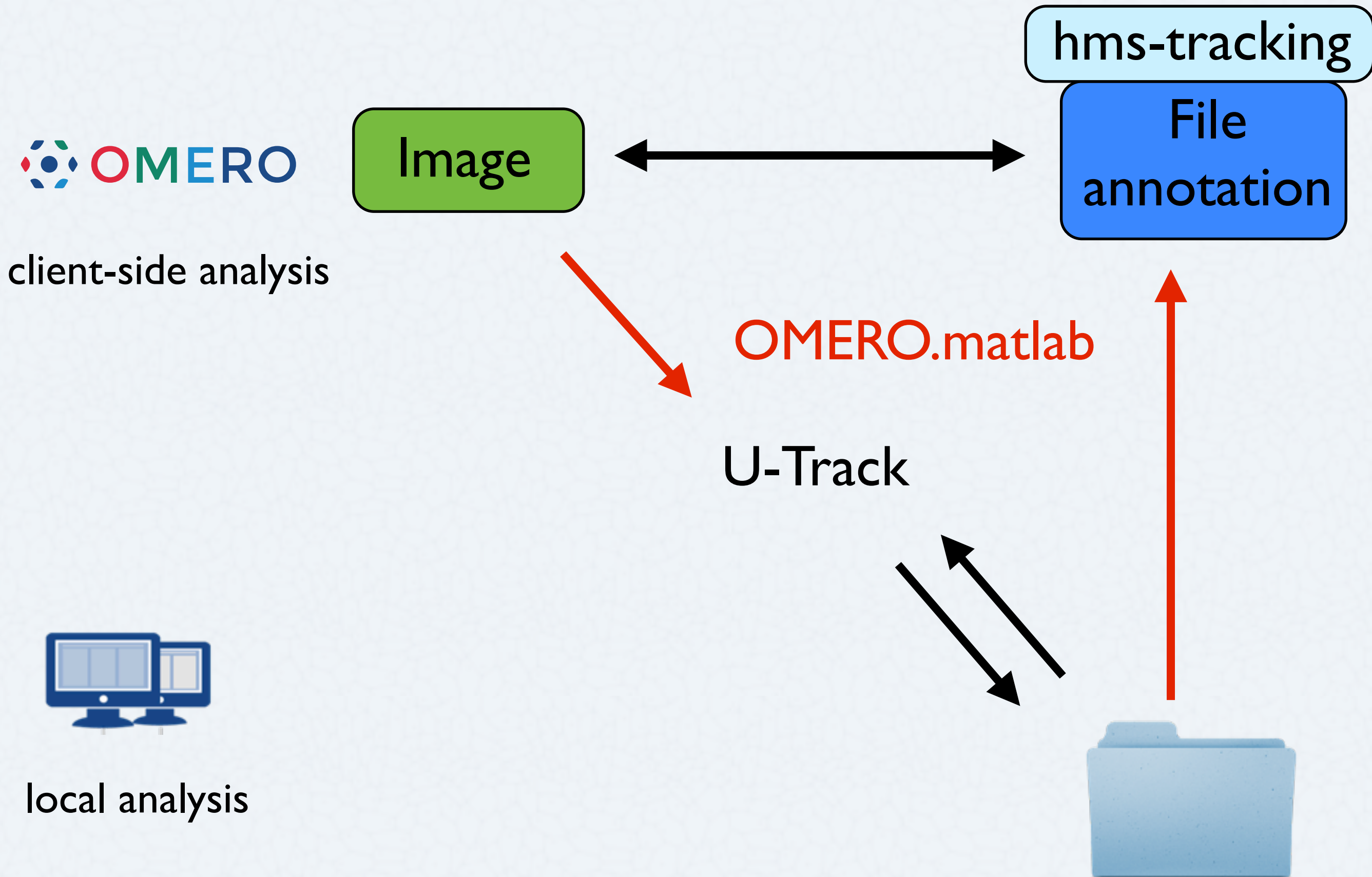
U-Track



local analysis

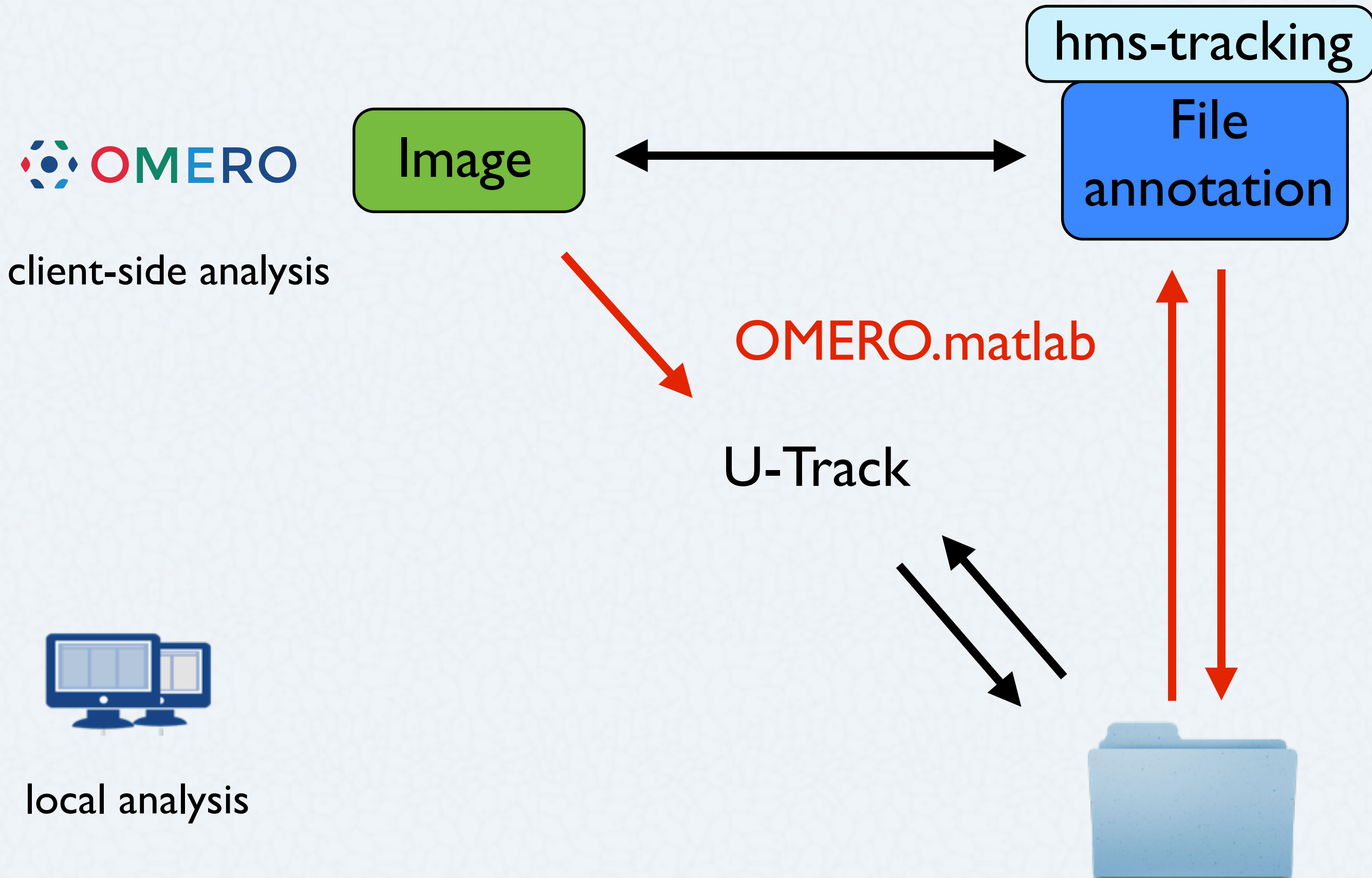


# Integration with OMERO





# Integration with OMERO





# Tracking in OMER: application

The screenshot displays the OMER application interface, titled "Sebastien Besson's Data Manager". The interface is divided into several panels:

- Projects Panel (Left):** A tree view showing the project structure. The "Welburn lab" project is expanded, showing sub-projects like "Sebastien Besson" and "Julie Welburn". Under "Julie Welburn", the "STLC\_31january2012" project is selected, listing various "eb3\_STLC" image files. The file "eb3\_STLC 6.tif" is highlighted.
- Workspace Panel (Center):** Displays "Workspace: 11 of 11 images" for the selected file "eb3\_STLC 6.tif (Feb 1, 2012)". It shows a grid of 11 small image thumbnails.
- Image Details Panel (Right):** Provides information about the selected image. The "General" tab is active, showing:
  - Image ID:** 203
  - Owner:** Julie Welburn
  - Description:** A text area for describing the image.
  - Archived:** A checkbox that is currently unchecked.
  - Acquired:** 2/1/12 8:10 PM
  - Imported:** 3/30/13 6:36 PM
  - Dimensions (XY):** 298 x 290
  - Pixel Type:** Unsigned 16-bit (2 byte)
  - Pixels Size (XY)  $\mu$ m:** 0.065x0.065
  - z-sections/timepoints:** 1 x 155
  - Channels:** 0
- Annotations Panel (Bottom Right):** Shows a list of annotations. The "HMS-tracking.zip" attachment is highlighted, with a yellow tooltip displaying its details:
  - Name:** HMS-tracking.zip
  - Owner:** Sebastien Besson
  - File ID:** 876
  - Date Added:** Friday, April 26, 2013 4:07:56 PM BST
  - Size:** 1.6 Mb
  - Added by:** Sebastien Besson

user-1

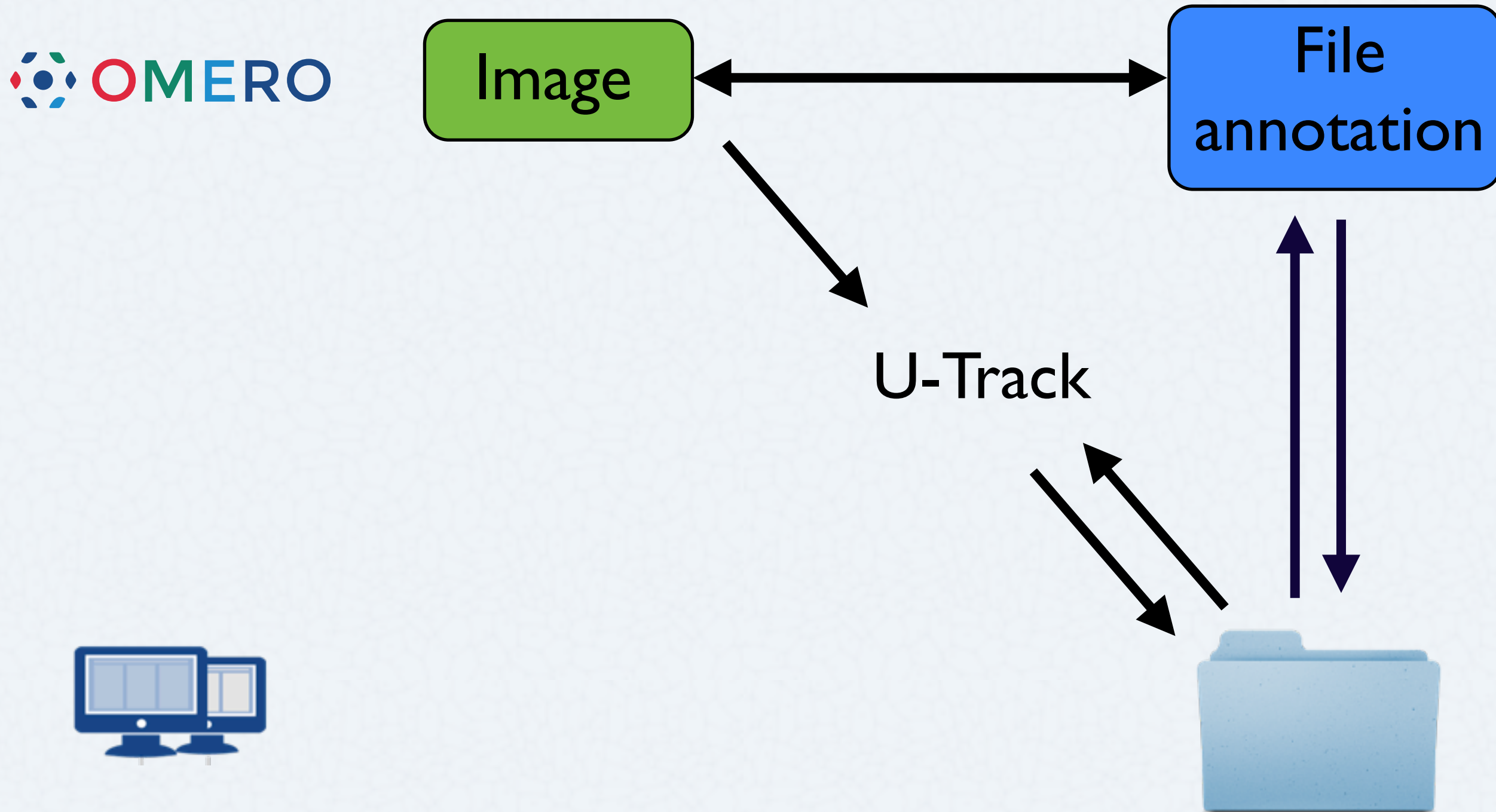
user-2

# Impact on OMERO resources

- Major rewriting of OMERO.matlab toolbox (4.4.7 and above) cf Tuesdays analysis workshop
- Resources set up for daily testing of OMERO.matlab and derived Matlab-based projects (e.g. U-Track)
- Future development
  - Stronger articulation between various Matlab projects: Michael Porter (Dundee), Ian Munro/Yuriy Alexandrov (Imperial)
  - More writing functions / better exposition of the permissions...
  - Addition of integration test suites



# Caching images for analysis

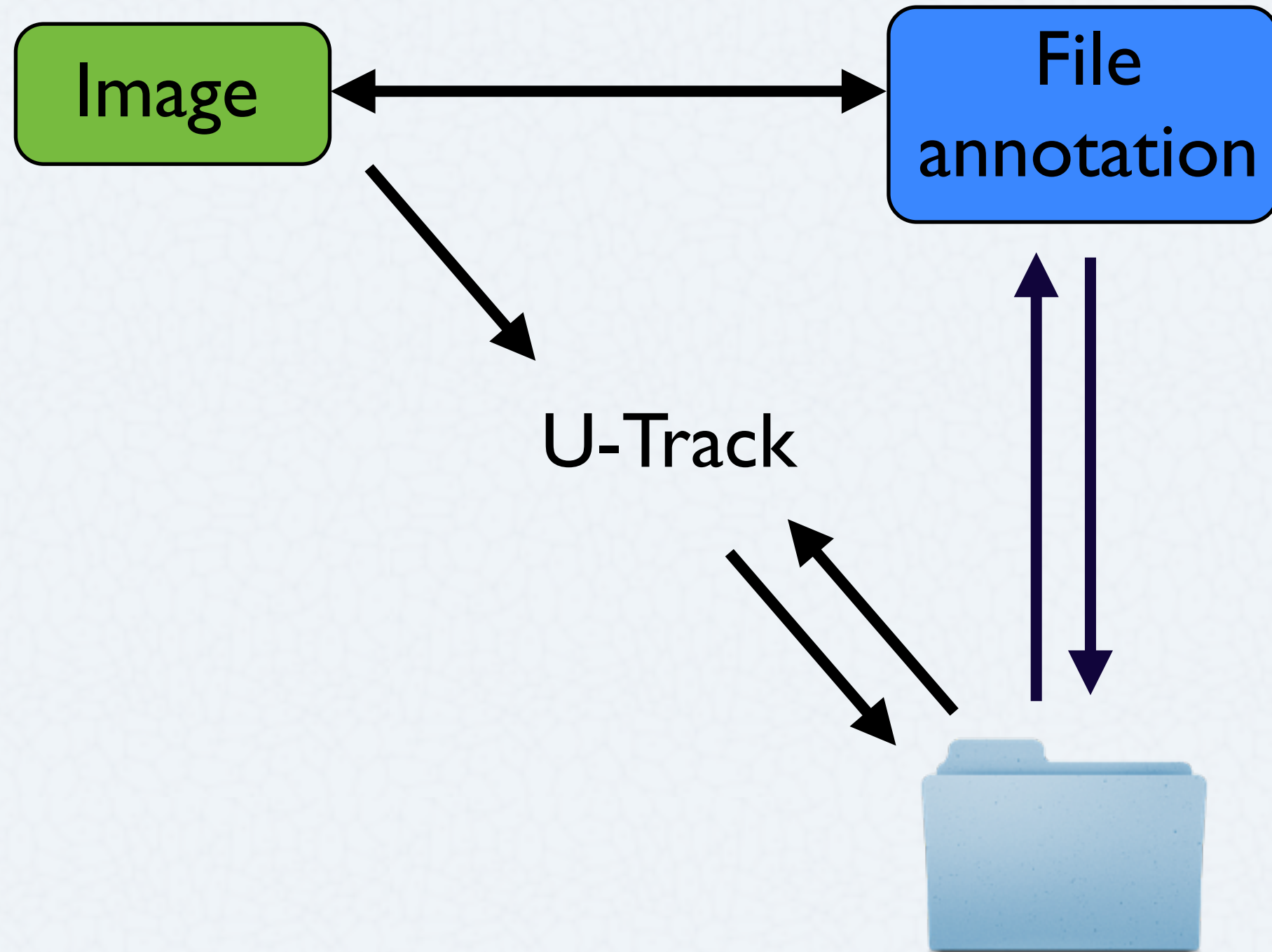


# Caching images for analysis



## Limitations

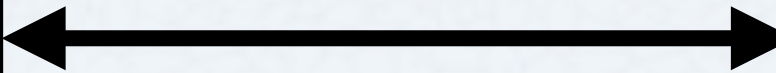
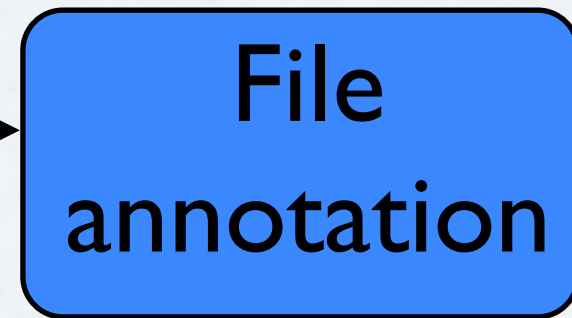
offline work



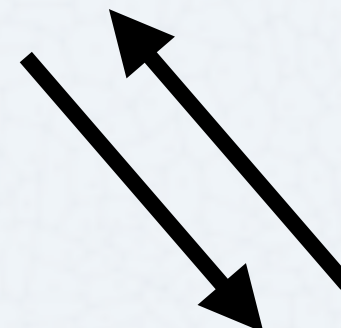


# Caching images for analysis

**WTCCB**  
**Edinburgh**



U-Track



## Limitations

offline work

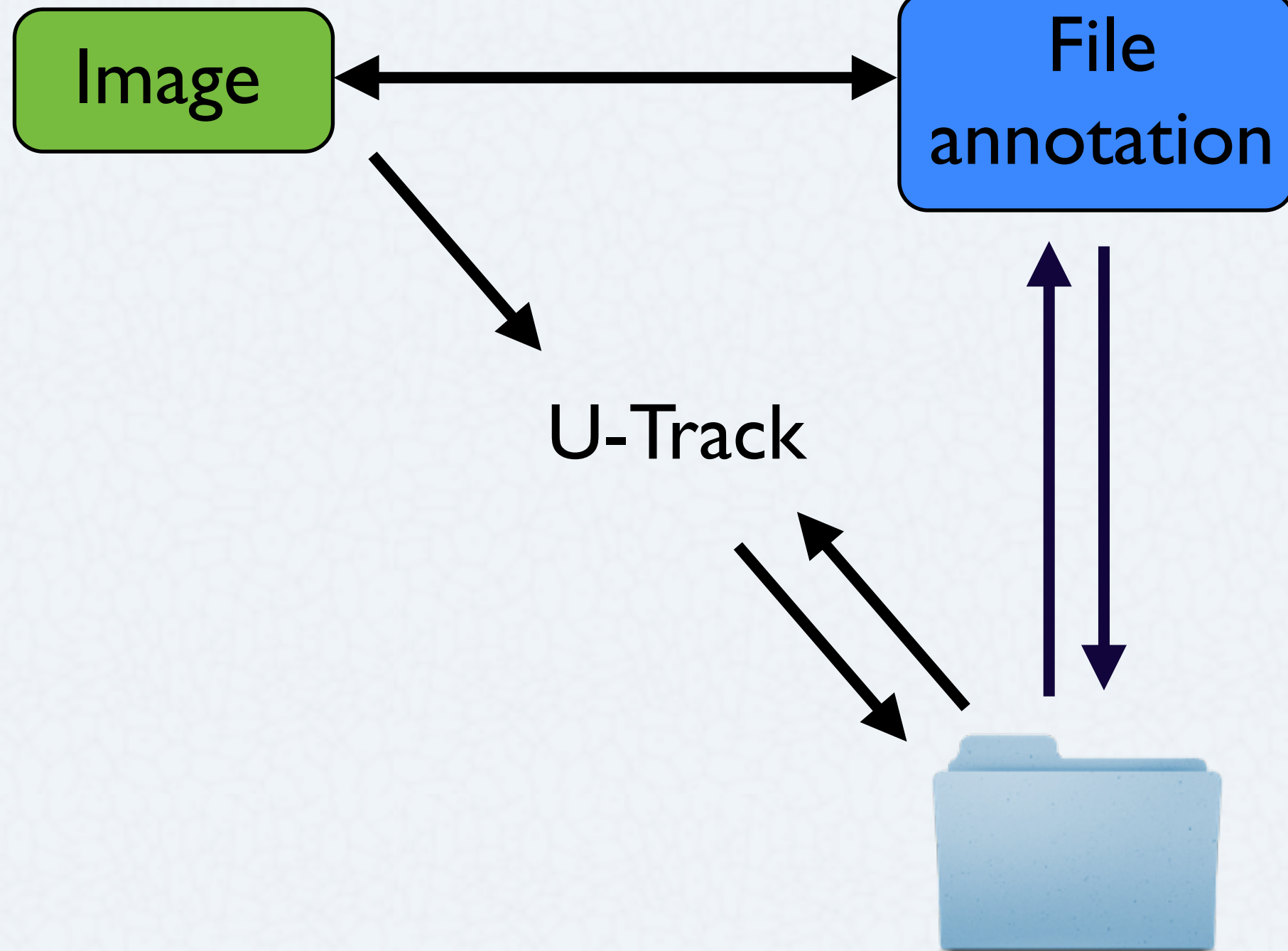
poor/distant connection



**UT Southwestern**  
**Dallas**

# Caching images for analysis

**WTCCB**  
**Edinburgh**



## Limitations

offline work

poor/distant connection

parameters optimization

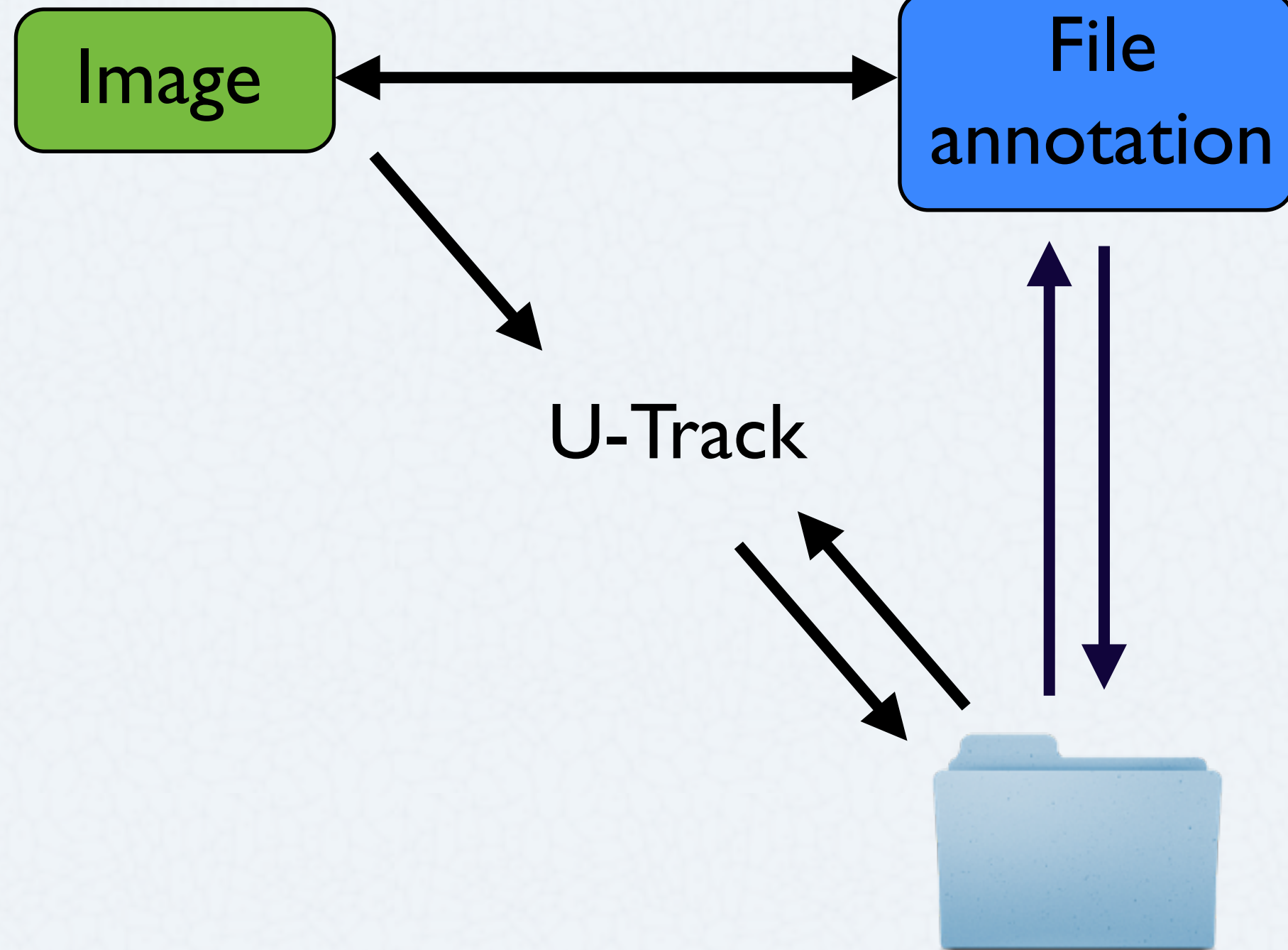


**UT Southwestern**  
**Dallas**



# Caching images for analysis

**WTCCB**  
**Edinburgh**



## Limitations

offline work  
poor/distant connection  
parameters optimization  
algorithm development



**UT Southwestern**  
**Dallas**

# Caching images for analysis

**WTCCB  
Edinburgh**

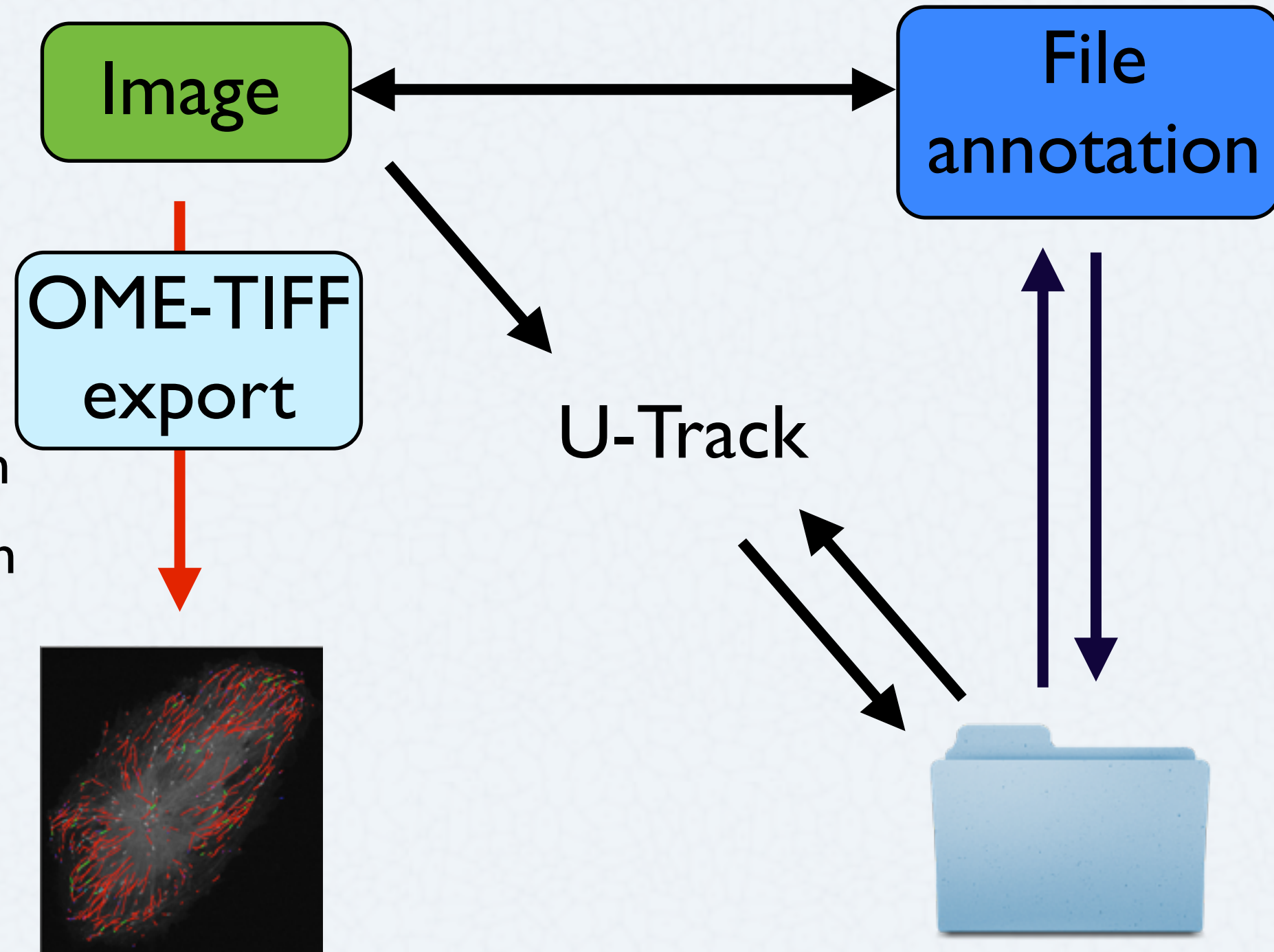


## Limitations

offline work  
poor/distant connection  
parameters optimization  
algorithm development



**UT Southwestern  
Dallas**





# Caching images for analysis

**WTCCB  
Edinburgh**

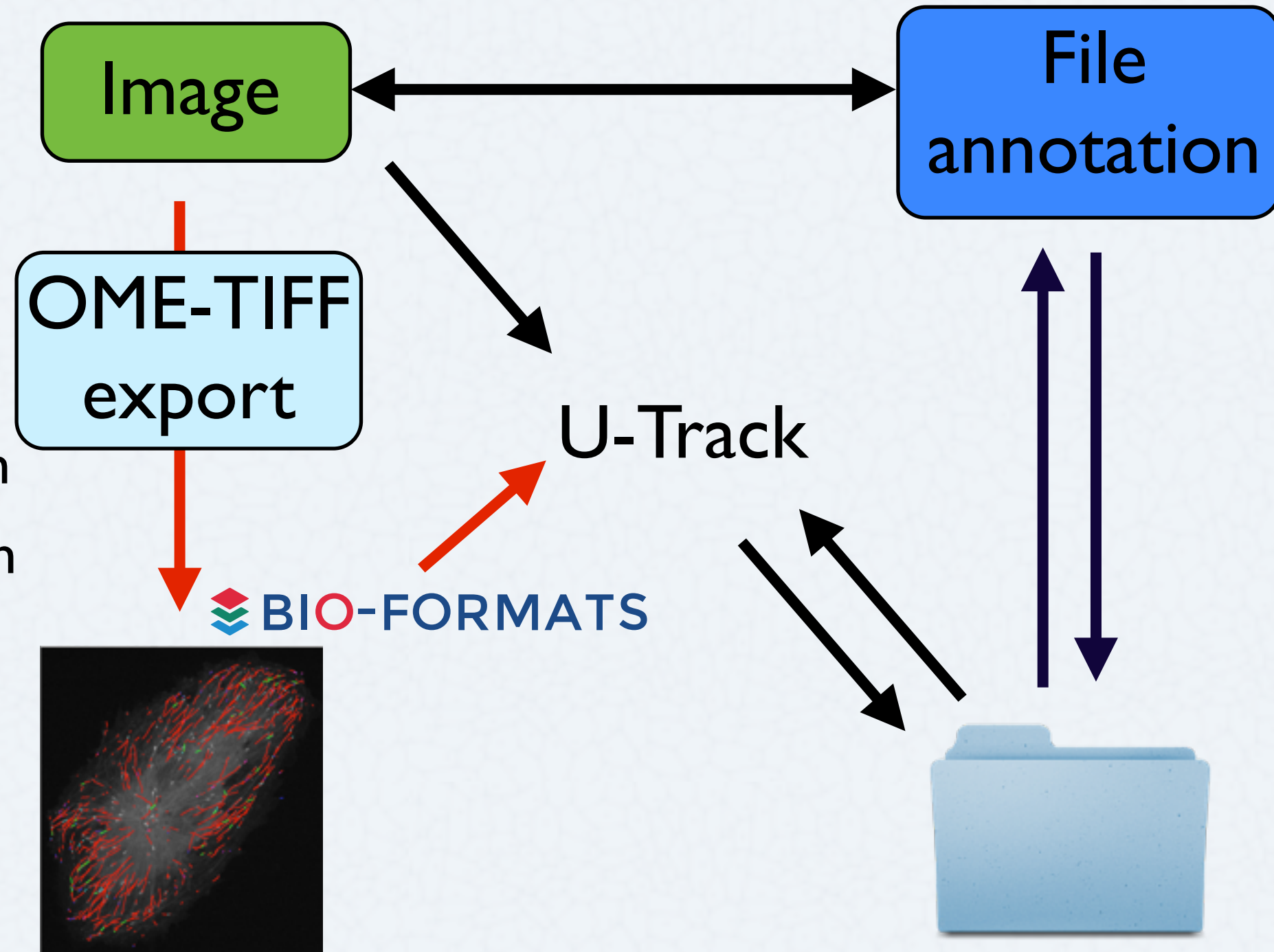


## Limitations

offline work  
poor/distant connection  
parameters optimization  
algorithm development



**UT Southwestern  
Dallas**



# Caching images for analysis

**WTCCB  
Edinburgh**



## Limitations

offline work

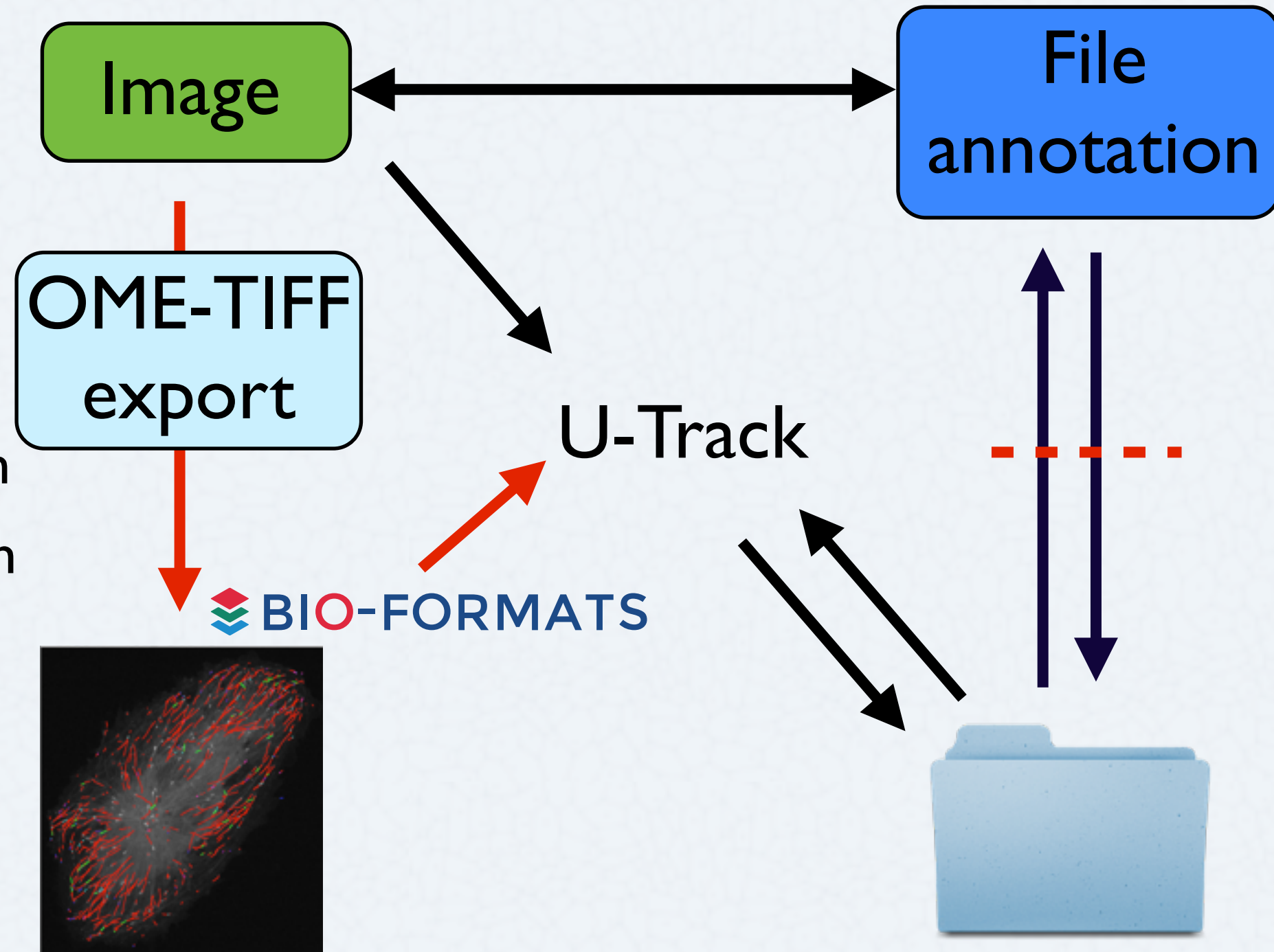
poor/distant connection

parameters optimization

algorithm development

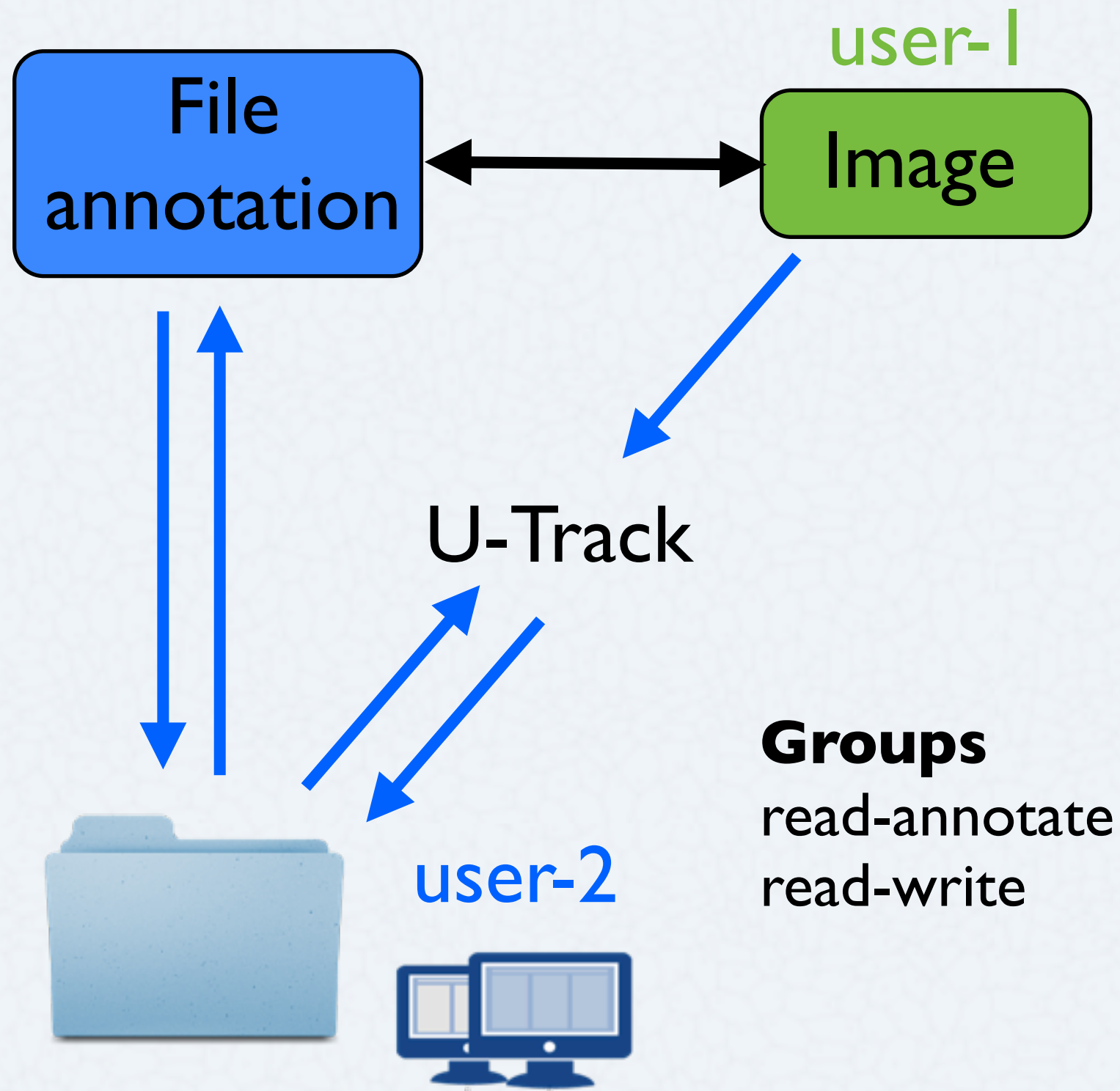


**UT Southwestern  
Dallas**



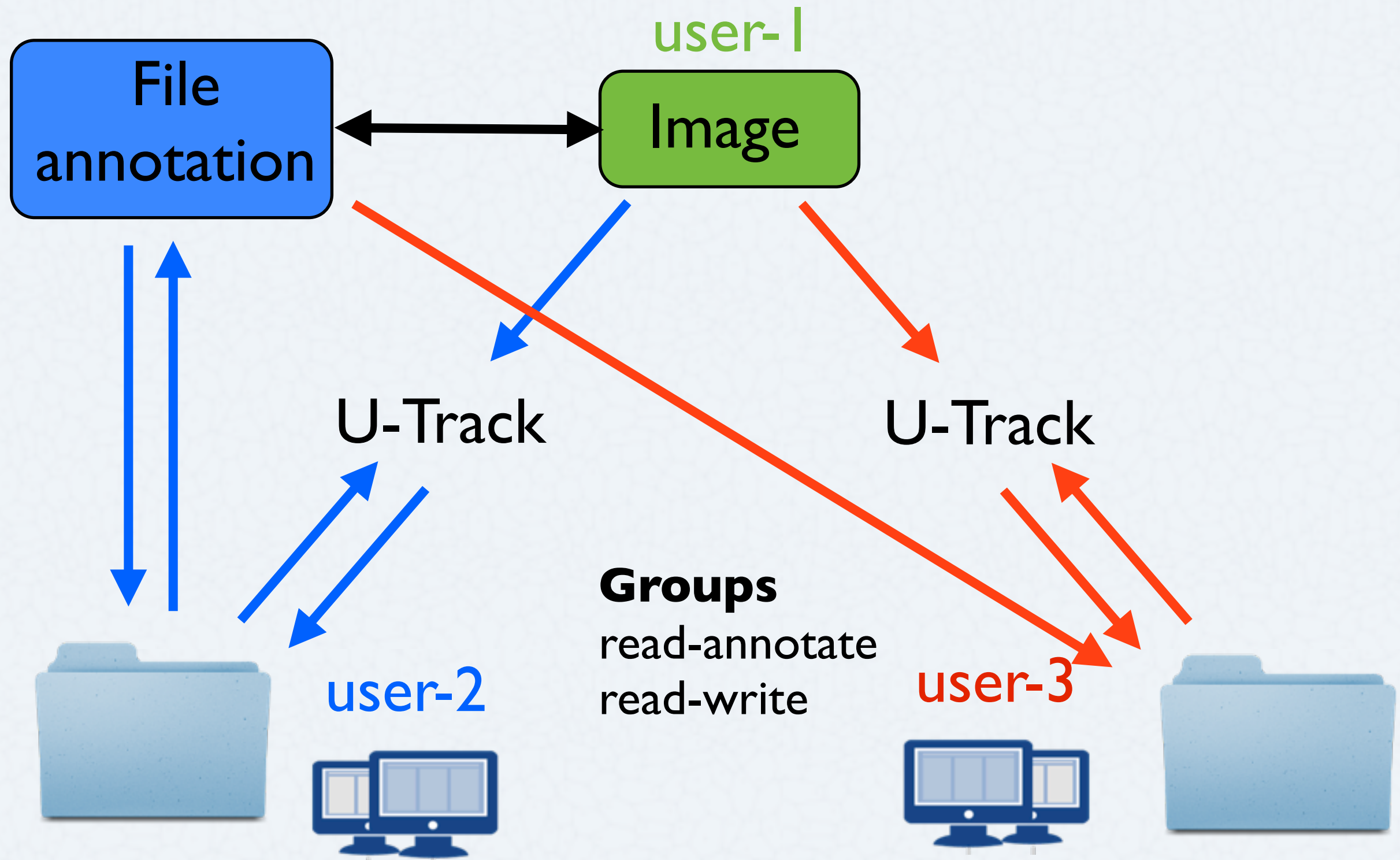


# Collaborative analysis

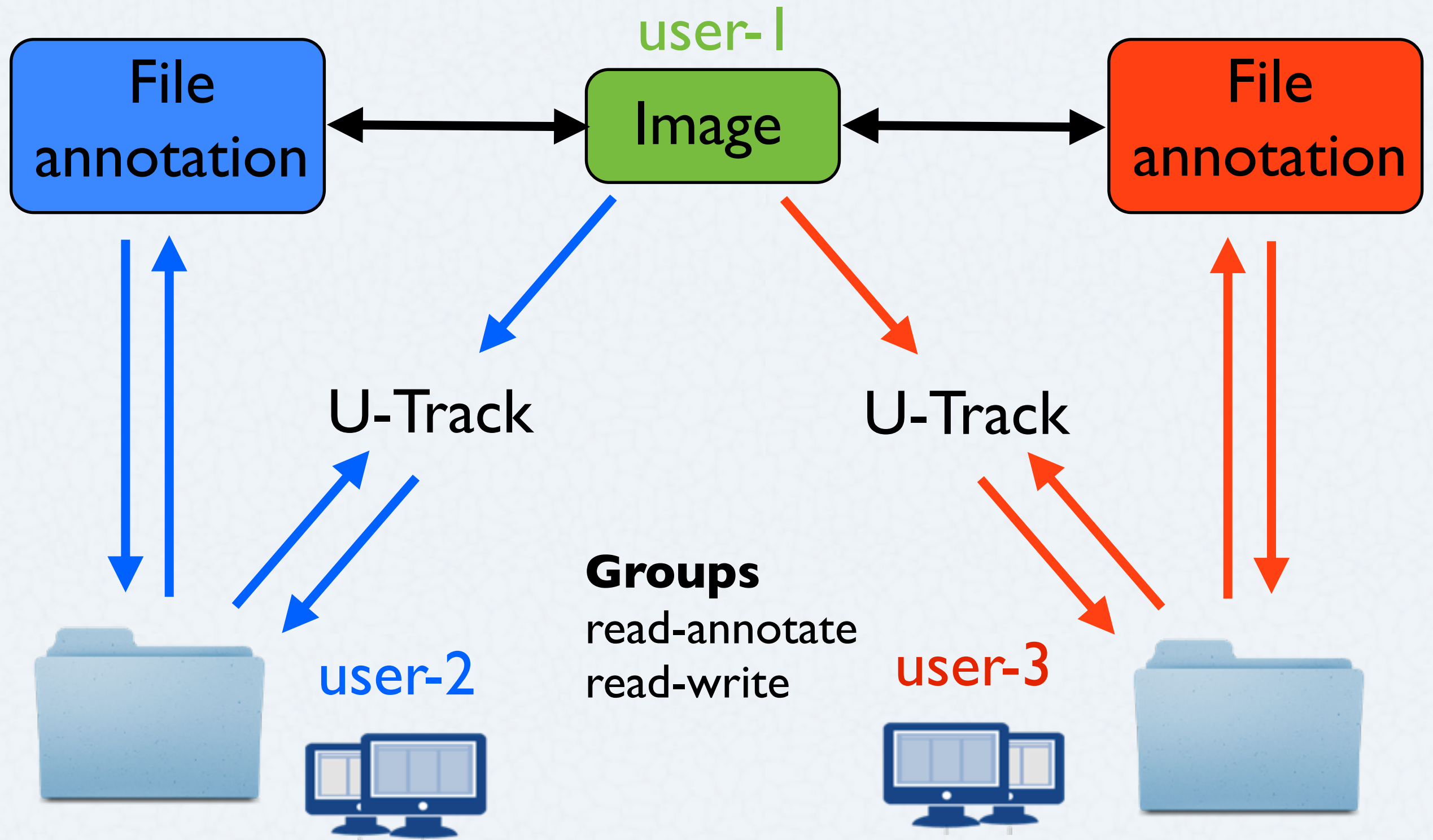




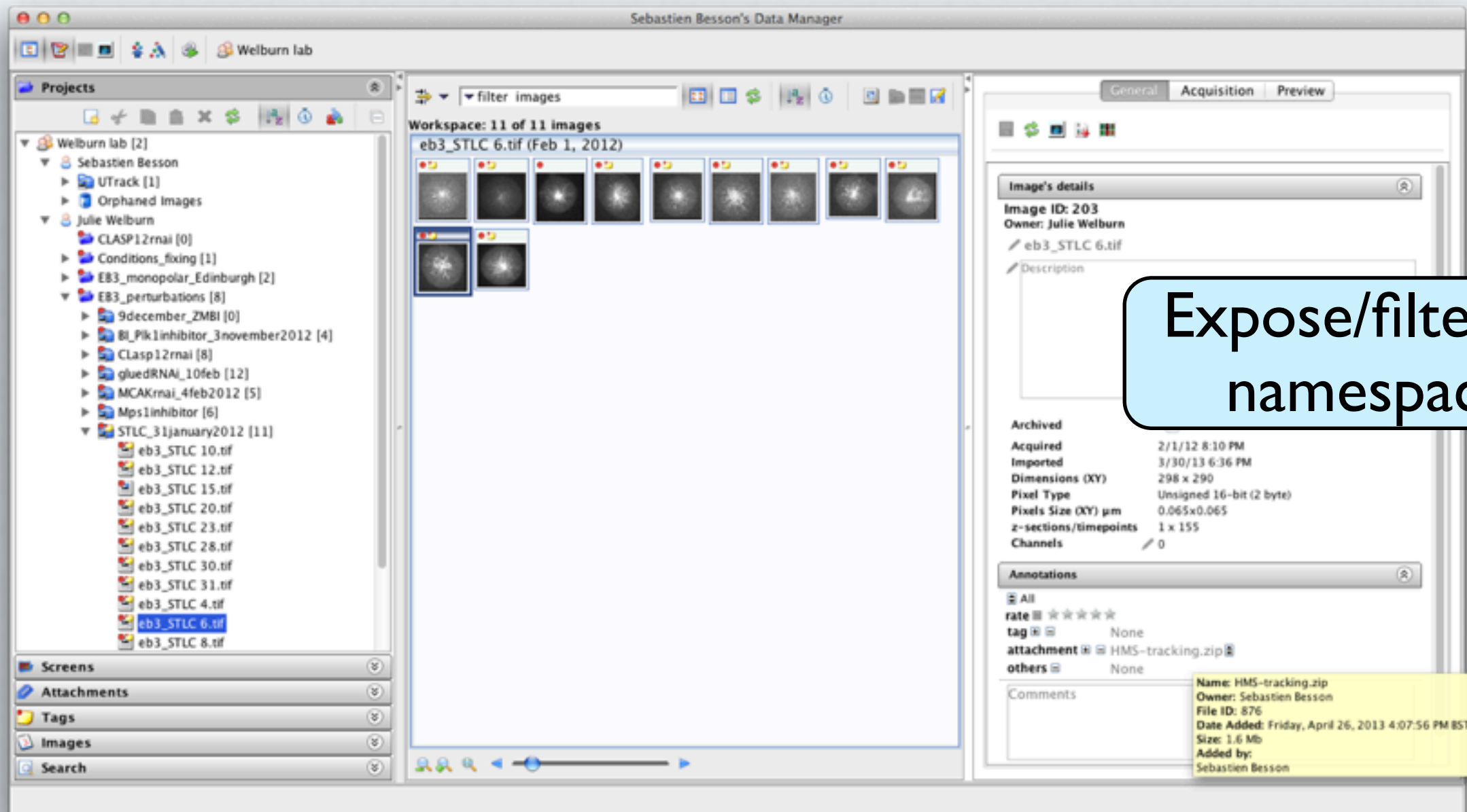
# Collaborative analysis



# Collaborative analysis



# Analysis integration in OMERO clients



Expose/filter by namespace

Export analysis: ROIs/tables

Open with menu



# Acknowledgments

## **Wellcome Trust Centre, Dundee**

Jean-Marie Burel  
Michael Porter  
Jason Swedlow  
OME team

## **Wellcome Trust Centre, Edinburg**

Sarah Young  
Julie Welburn

## **UT Southwestern, Dallas**

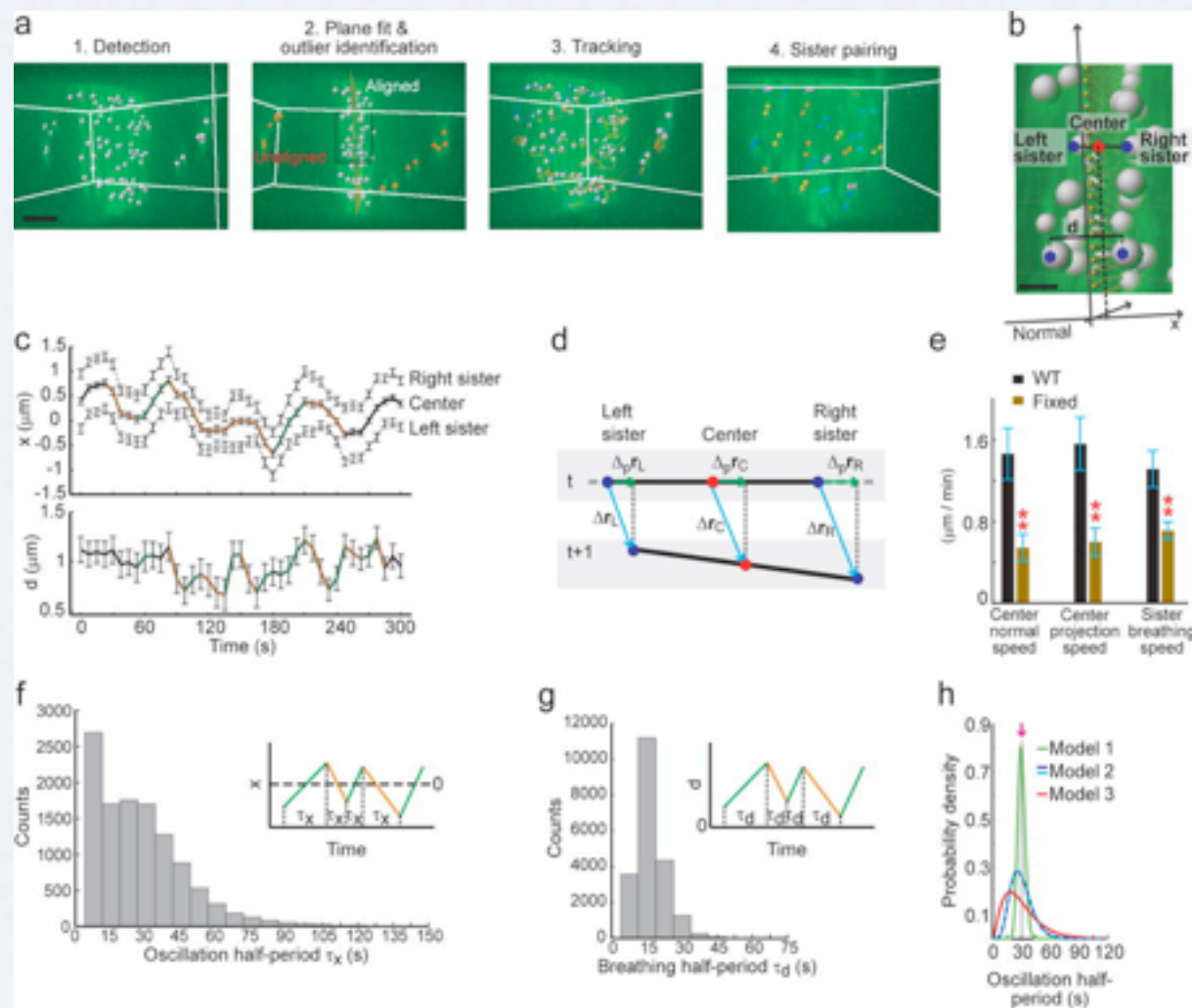
Khuloud Jaqaman

## **Harvard Medical School, Boston**

Hunter Elliott  
Mei Rosa Ng  
François Aguet  
Gaudenz Danuser

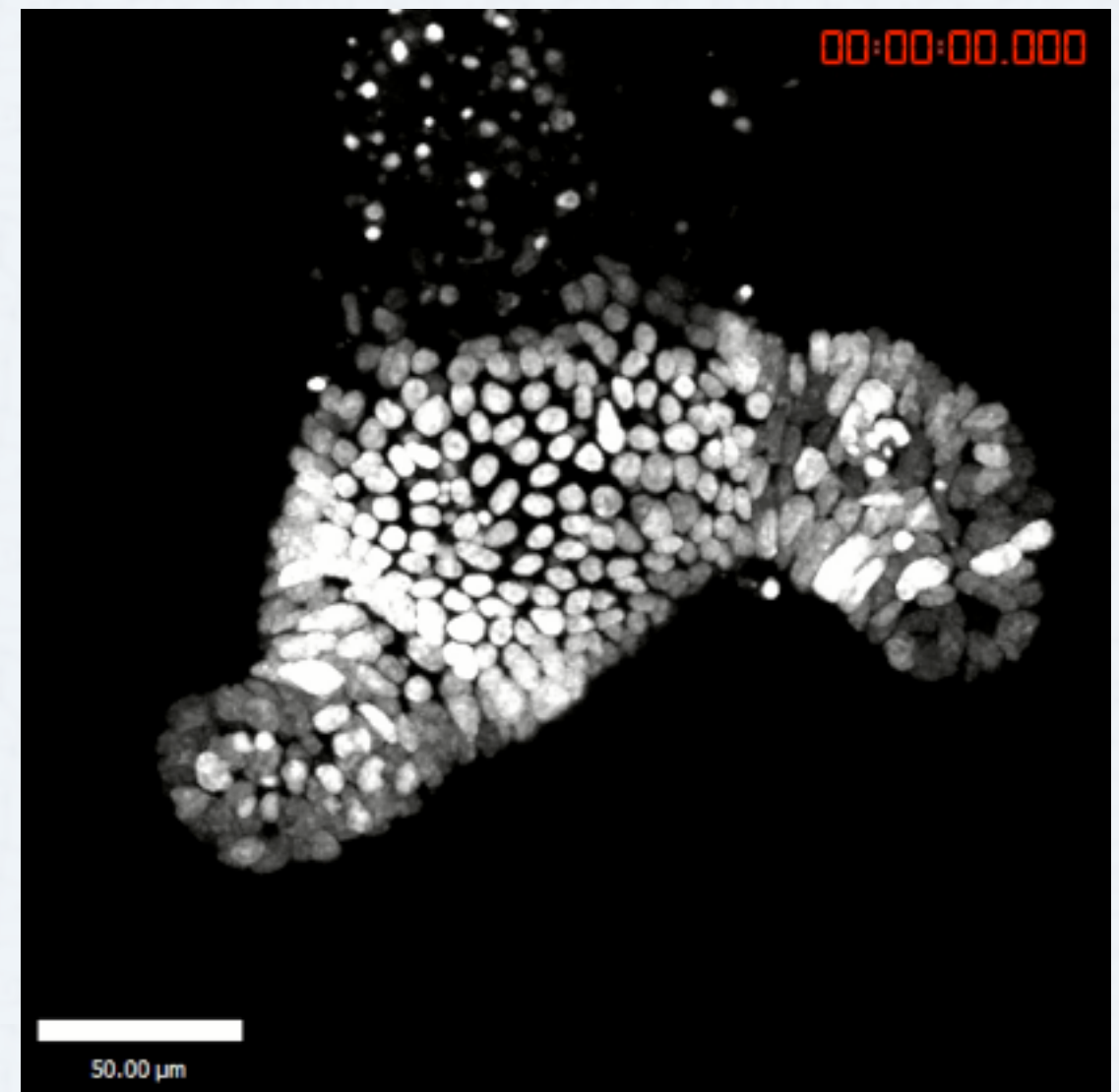
# Suppoer 3D support

## Mammalian kinetochores



Jaqaman et al. JCB 2010

## 3D nuclei tracking



Nathke lab, Dundee

# Tracking in OMERO: example (II)

