Remote ImageJ -
Running macros on a distant machine

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ImageJ
User & Developer Conference
27.-29. October 2010

Remote ImageJ - Outline

- the context at the MRI imaging facility

- design decisions

- components

  - SIJAME – messaging middleware

  - Modal-Dialog-Killer

  - Macro_IO_Settings

  - Remote-Filesystem-View

  - Remote Macro Runner

- conclusions and future work

531

150

59

11

40000

13

```
// wound healing macro

run("Find Edges", "stack");
run("Invert", "stack");
setAutoThreshold("Pdark");
run("Convert to Mask");
resetThreshold();
run("Invert", "stack");
run("Dilate", "stack");
```
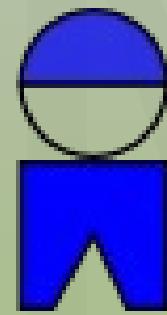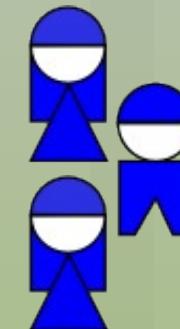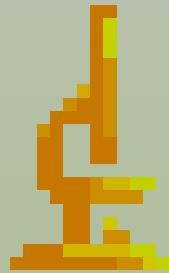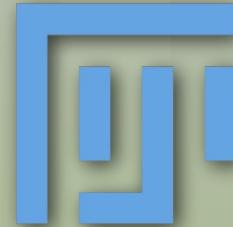
- development of image analysis and automation solutions on demand

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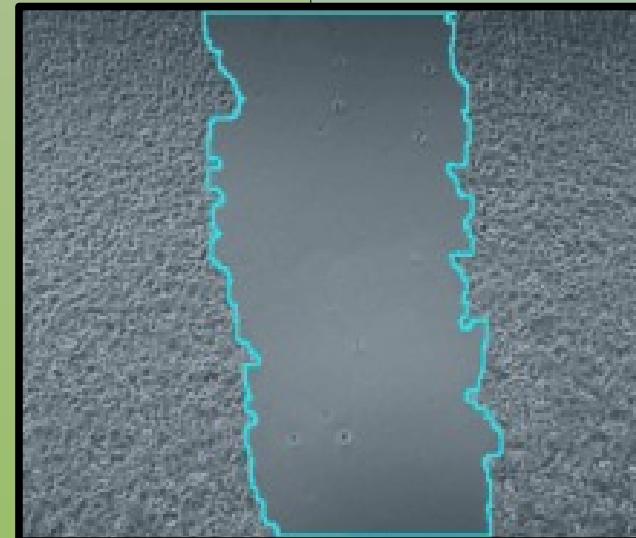
Motivation – The Problem

- ✔ automated image analysis 😊

- ✗ macro-batch-processing blocks machines
- ✗ installation / maintenance on many machines
- ✗ transfer of images between machines 🙁

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Motivation – The Solution: Cicero

- upload images to file-server

- index images in database

- access via web-application

- run macros from web-application

ImageJ server

huygens server

upload

application server

fileserver

webserver

database

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Motivation – The Solution: Cicero

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Remote ImageJ – Analysis

- Remote ImageJ - run macros on a distant machine

ImageJ
server

```
run("Ma)
RoiManag
...
```

fileserver

- images are on a fileserver
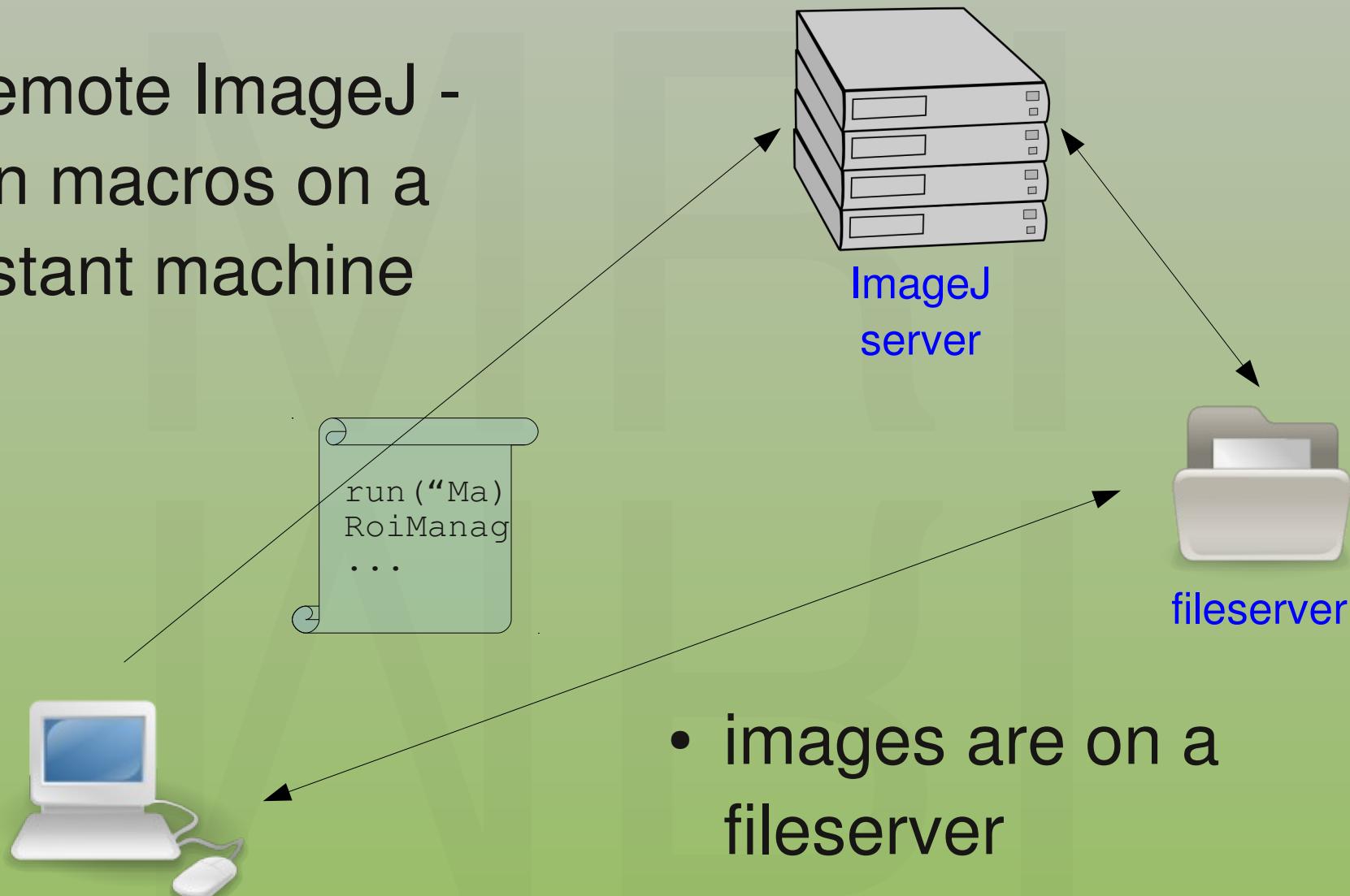
Remote ImageJ – Analysis & Design

- use ImageJ and plugins only

- send macros from client to server and answers back

  - asynchronous communication

- access paths as seen by the server

  - synchronous communication

- server can be headful

  - avoid modal dialogs

- modularity

  - independent components that play together

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Remote ImageJ – Components

- Existing

  - SIJAME – SImple JAva Message Exchange

  - Modal-Dialog-Killer

  - Macro_IO_Settings

  - Remote-Filesystem-View

  - Remote Macro Runner

- Future

  - Queue-Manager

RemoteJ	▷		Macro IO Settings
Segmentation	▷		Modal Dialog Killer
Stacks	▷		RFS Client
Texture	▷		RFS Server Console
Tools	▷		RMR Client
			RMR Server Console

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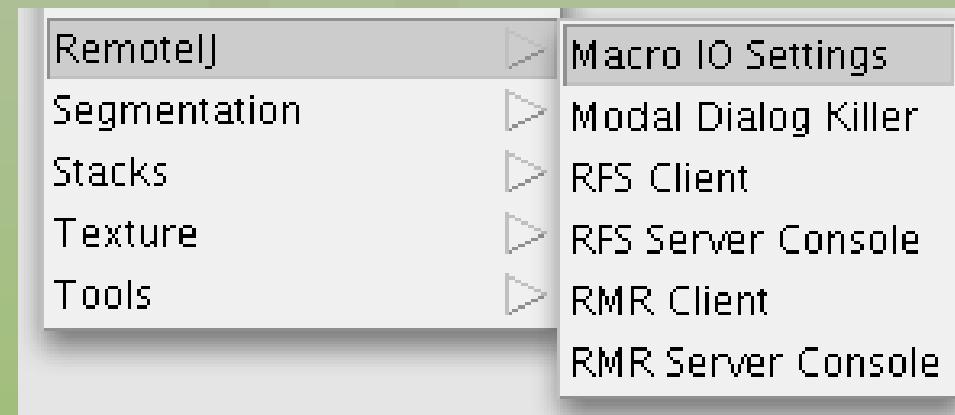
Remote ImageJ – SIJAME

- SIJAME

  - socket based communication

  - messages are transferred binary

  - message can carry serializable data

  - server can put message in a queue

  - synchronous or asynchronous communication

  - symetric:

    - client is a server

    - answer-queue

Log Viewer

```
22-Oct-2010 16:48:12
fr.cnrs.mri.sijame.connection.SIJAMEServer run
INFO: Listening on port 4000...

22-Oct-2010 16:48:49
fr.cnrs.mri.sijame.connection.SIJAMEServer run
INFO: Listening on port 4001...

22-Oct-2010 16:48:49
fr.cnrs.mri.sijame.connection.SIJAMEServer run
INFO: Got connection from
Socket[addr=/127.0.0.1,port=35640,localport=4000]
```

SIJAME asynchronous

2. server puts message
in a queue

ImageJ
server

3. consumers are informed
when the first message changes

1. client sends message,
closes connection
and keeps on working

4. consumer sends an
answer-message back

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SIJAME synchronous

ImageJ server

2. consumers are informed that a message arrived
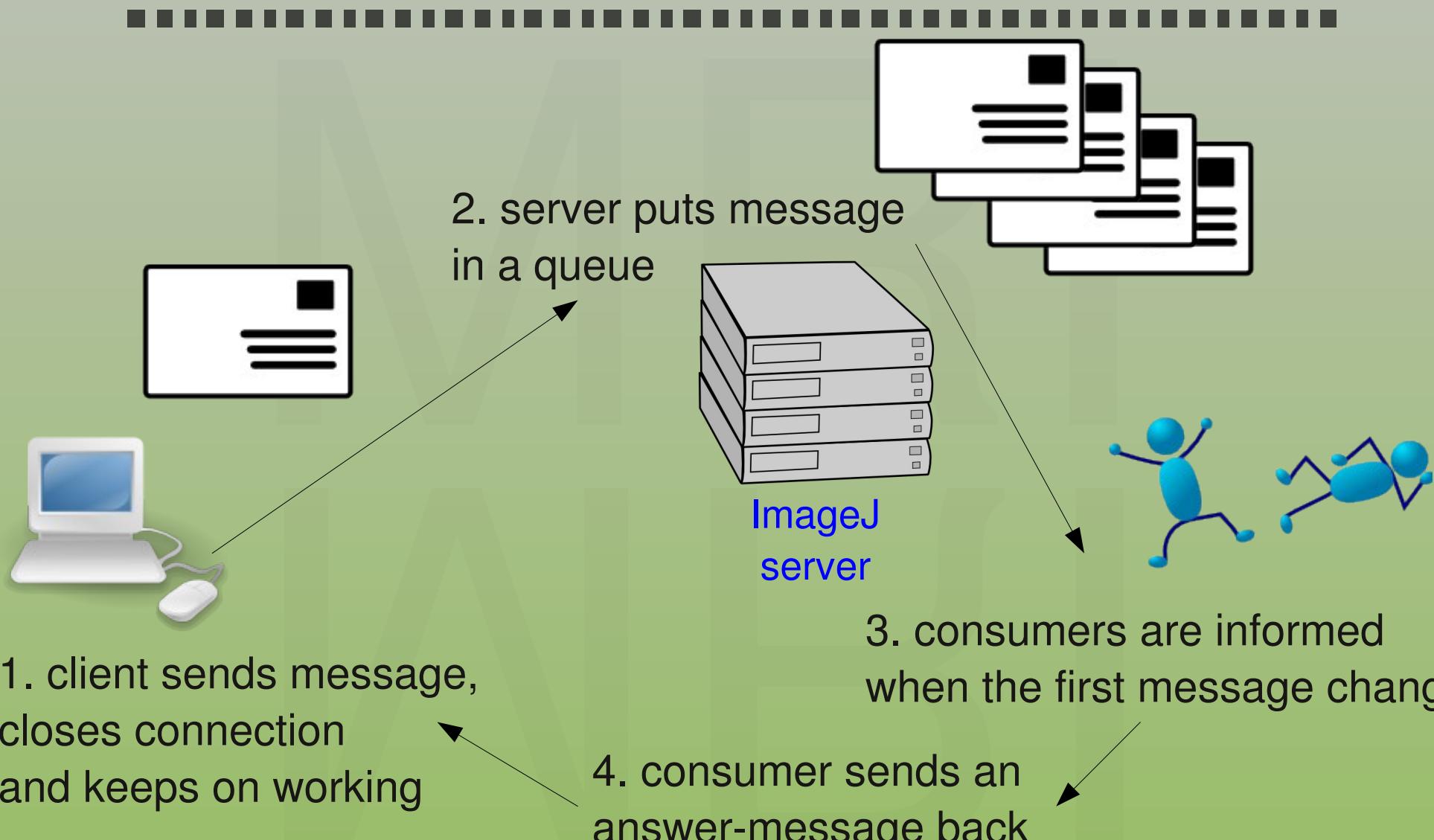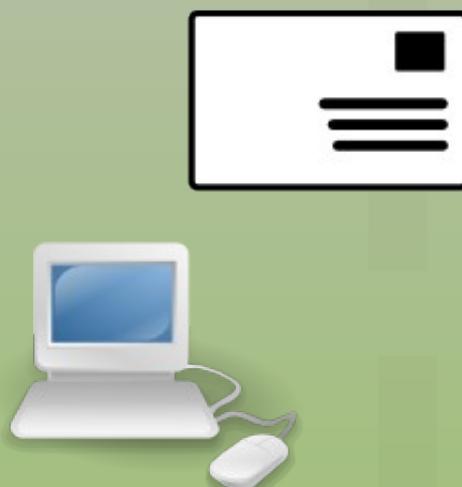
1. client sends message and waits for answer,
4. sends close to finish conversation

3. consumer sends answer on the same channel
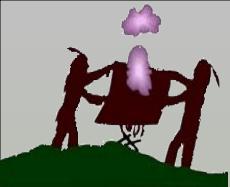
- communication middleware SIJAME

- problem of modal dialogs on the server

Modal Dialog Killer

GenericDialog

WaitForUserDialog

GenericDialog

Select the input folder!

New F

Folders

./
../
Desktop/
Docume

Selectio

Modal Dialog Killer

stop

Fri Oct 22 17:59:00 CEST 2010 - ij.gui.GenericDialog:enter a number
Fri Oct 22 17:59:09 CEST 2010 - ij.gui.WaitForUserDialog:Action Required
Fri Oct 22 17:59:19 CEST 2010 - javax.swing.JDialog:Select the input folder!
Fri Oct 22 17:59:25 CEST 2010 - ij.gui.MessageDialog:No Image
Fri Oct 22 17:59:30 CEST 2010 - ij.gui.GenericDialog:Macro Error

- communication middleware SIJAME

- problem of modal dialogs on the server

- **how to specify input files and folders for macro**

specify input – standard approach

```
inDir = getDirectory("Select the input folder!");
files = getFileList(inDir);
```

- folder can contain other images

  - need to filter

- code to load dependent files

  - naming scheme can change

➔ edit lists of files instead of selecting folders

Batch Process

Input... `/in/01/`

Output... `/home/baecker/out/`

Output Format: TIFF

Add Macro Code: [Select from list]
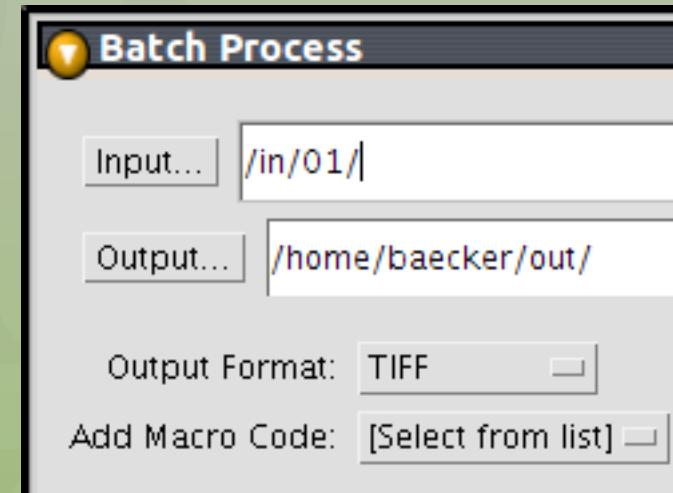
YGZG7-gfp001
YGZG7-gfp002

YGZG7-dapi001
YGZG7-dapi002

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Macro_IO_Settings

filter unwanted

list editor

/in/01/stripes.tif
/in/02/new/AuPbSn40.tif
/in/02/new/AVG_bat-cochlea-volume.tif
/in/02/new/AVG_bat-cochlea-renderings.tif
/in/03/bridge.tif
/in/03/boats.tif
/in/04/céllèàëâä.tif
/in/04/Tree Rings.tif

add...   remove selected   close

IO Settings

| file lists | input folders | output folders |

/in/01/stripes.tif,/in/02/new/AuPbSn40.tif,/in/02/new
/in/04/céllèàëâä.tif,/in/04/Tree Rings.tif,/in/03/bridge

add...   edit...   remove selected

add a list
• one per channel
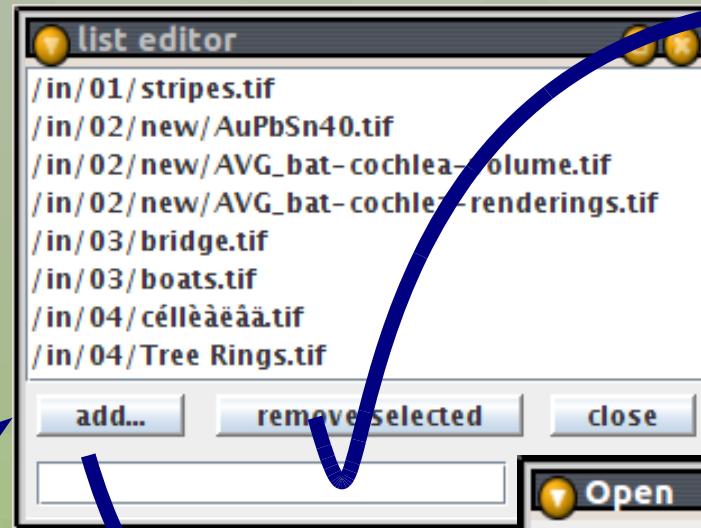
add files
• select multiple files
• select a folder (recursively)
• tif, all images, all files

Open

Look In:

01 03 05
02 04

File Name:

Files of Type: tif images

Open   Cancel

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18/29
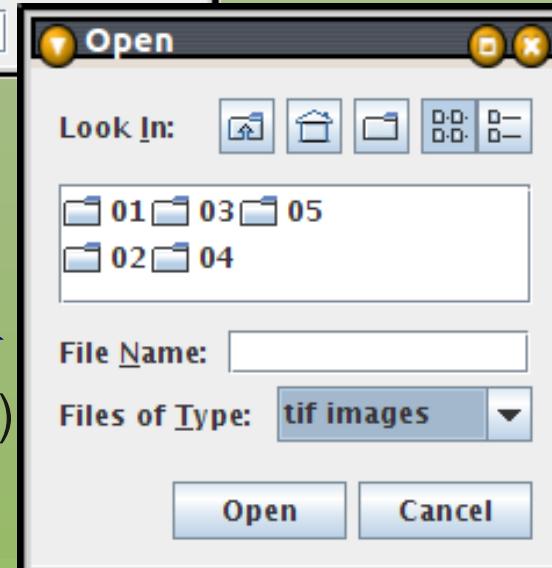
Macro_IO_Settings

```
call("fr.cnrs.mri.macro.io.IOSettings.resetFileLists");
call("fr.cnrs.mri.macro.io.IOSettings.show");

waitForUser("Please select the input files and press ok");

list = call("fr.cnrs.mri.macro.io.IOSettings.getFileList");
if (list=="none") {
    IJ.log("No files selected! Macro stopped."); return;
}

files = split(list, ",");

for (i=0; i<files.length; i++) {
    file = files[i];
    ...
```

lists of lists as strings
· lists separated by ;
· elements separated by ,
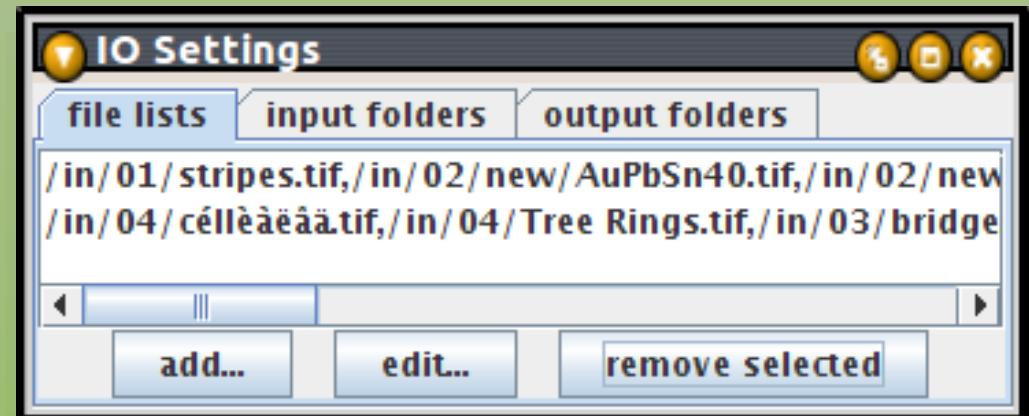
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- communication middleware SIJAME

- problem of modal dialogs on the server

- how to specify input files and folders for macro

- **distant input files and folders**

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Remote-Filesystem-View

Remote Filesystem Client

server: orion   port: 4000   test

status: connected to orion:4000

info: Ping successful

stop

Remote Filesystem Server C

port: 4000

status: running

started: Mon Oct 25 16:47:10 CEST

stopped:

stop   log
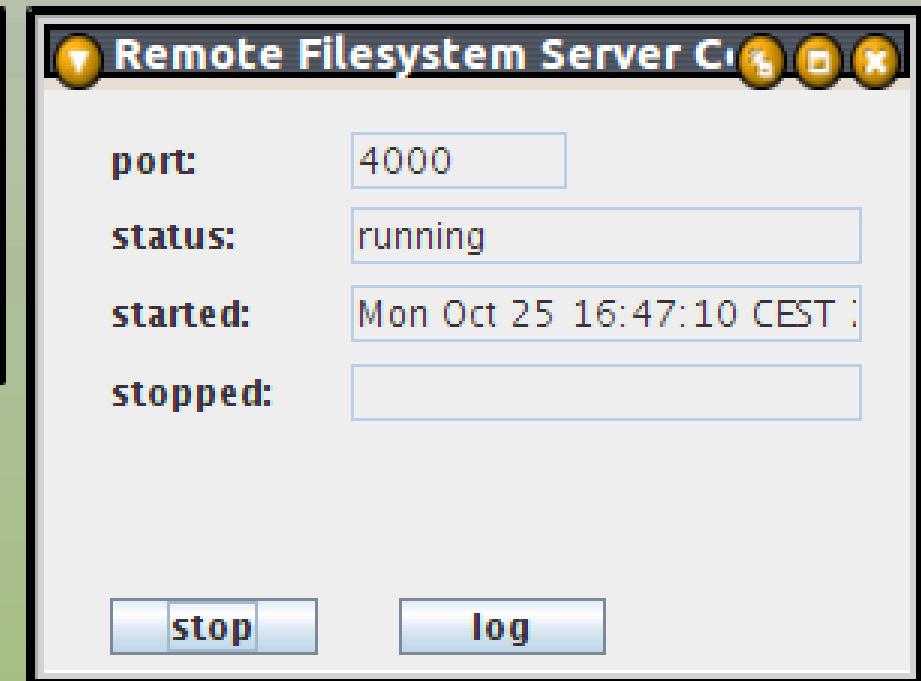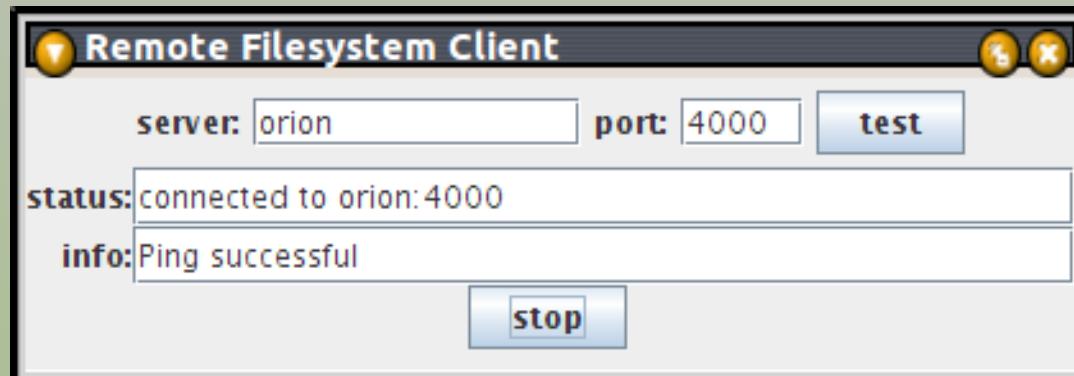
- when connected io-settings will show remote paths in FileDialog

Remote-Filesystem-View

IO Settings

file lists | input folders | output folders

/in/01/stripes.tif,/in/02/new/AuPbSn40.tif,/in/02/new

/in/03/bridge

Open

Look In:

01 03 05
02 04

File Name:

Files of Type: tif images

Open | Cancel
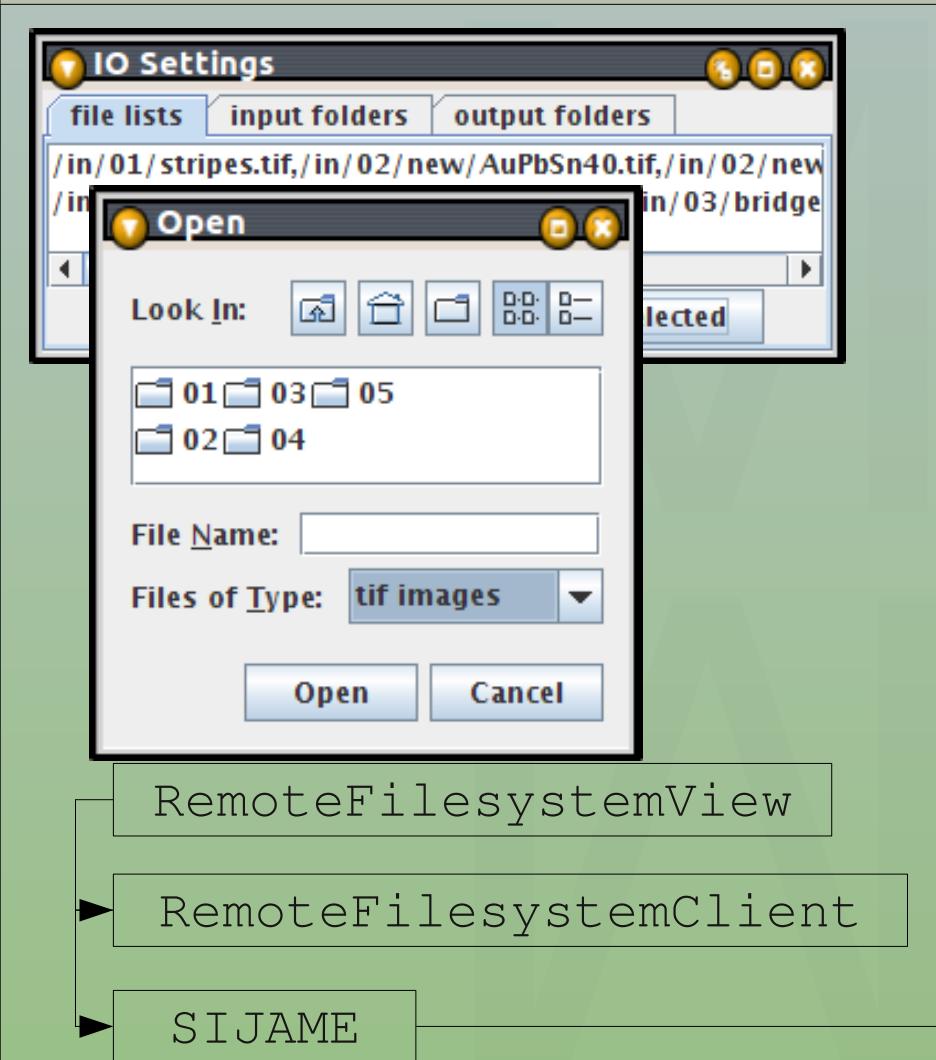
- configure visible root-folder

- use folders:
  - <login-name>
  - common
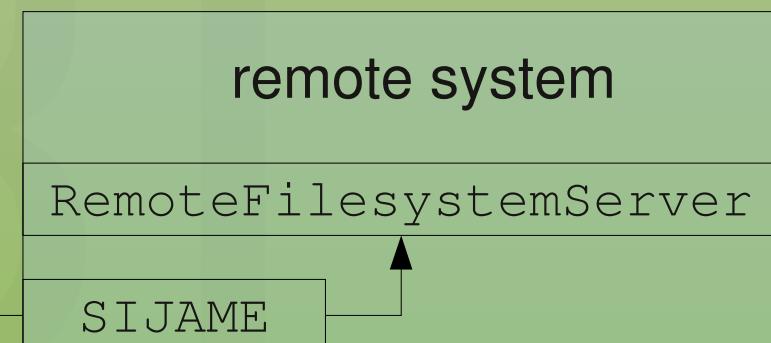
RemoteFilesystemView

RemoteFilesystemClient

SIJAME

remote system

RemoteFilesystemServer

SIJAME

synchronous

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- communication middleware SIJAME

- problem of modal dialogs on the server

- how to specify input files and folders for macro

- distant input files and folders

- **run macros on a remote machine**

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Remote-Macro-Runner Client

- send macro + io-settings

- io-settings can use remote-filesystem-view

- asynchronous communication

- macro must have return value

- runs SIJAME server to get answers back

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Remote-Macro-Runner Server

- queue incoming messages

- messages are handled in the order of arrival

- use modal-dialog-killer

- set io-settings from message and execute macro

- send answer message with return value back to client

Remote Macro Runner Serv

port:	4000
status:	running
started:	Mon Oct 25 17:37:03 CEST
stopped:	
macros executed:	28
macros waiting:	0

stop　　　**log**
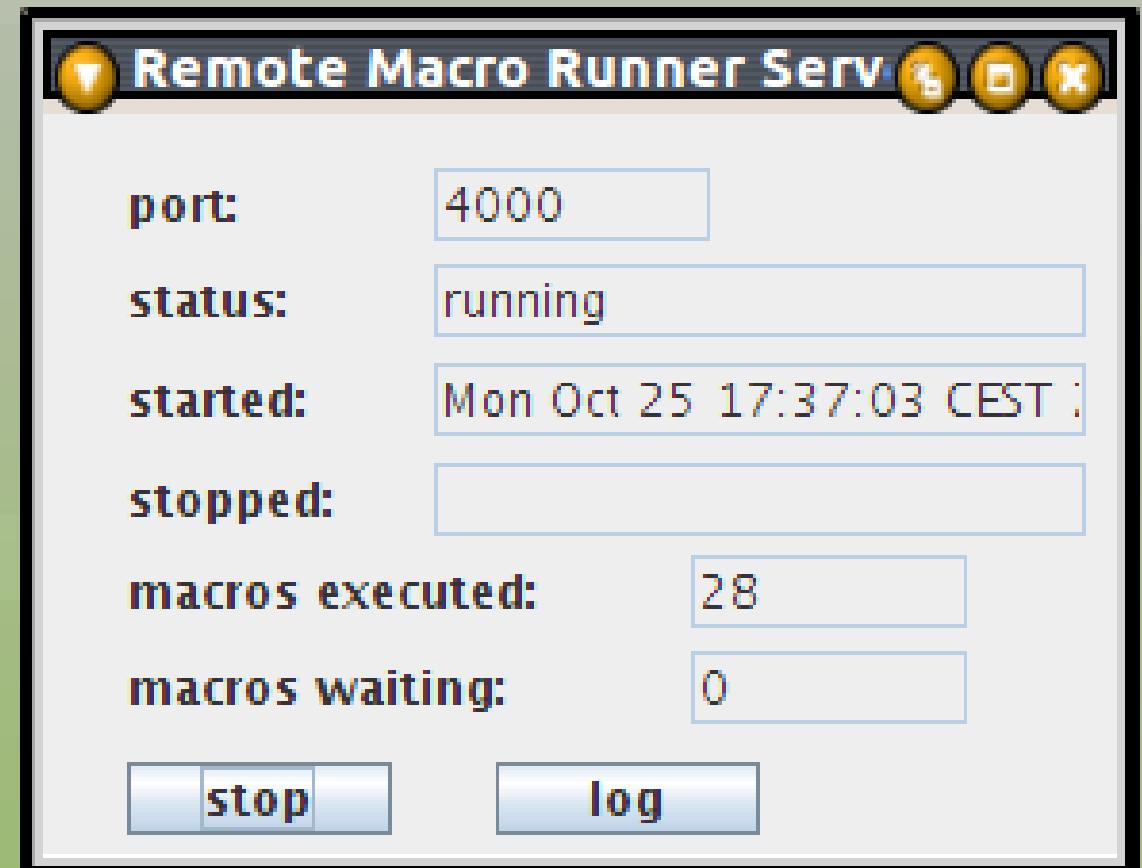
• multiple clients can use the same server in the same time

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Conclusions

- communication middleware SIJAME

  - synchronous and asynchronous communication

- problem of modal dialogs on the server

  - Modal-Dialog-Killer

- how to specify input files and folders for macro

  - Macro_IO_Settings

- distant input files and folders

  - Macro_IO_Settings + RemoteFilesystemView

- run macros on a remote machine

  - RemoteMacroRunner

ImageJ
server

fileserver

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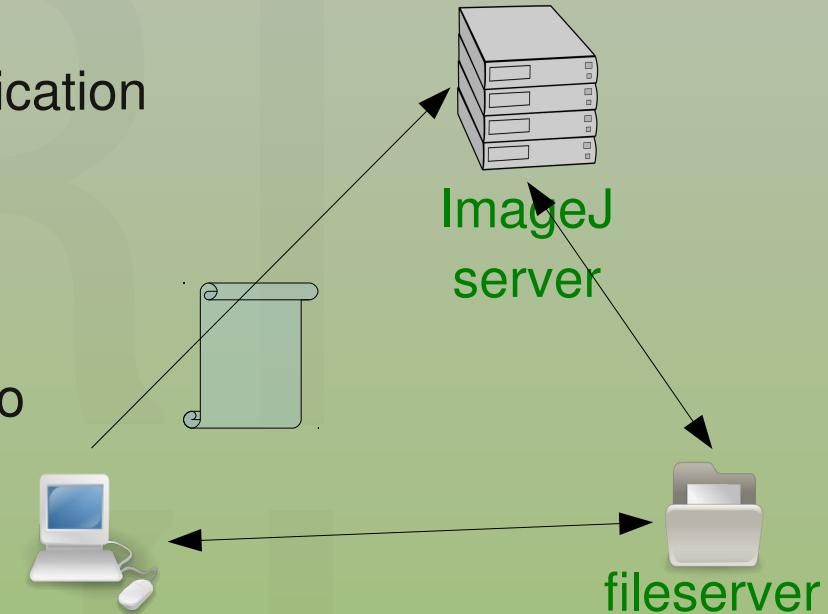
Future Work

Queue-Manager

ImageJ
server

```
run("Ma)
RoiManag
...
```

```
run("Ma)
RoiManag
...
```

ImageJ
server

fileserver
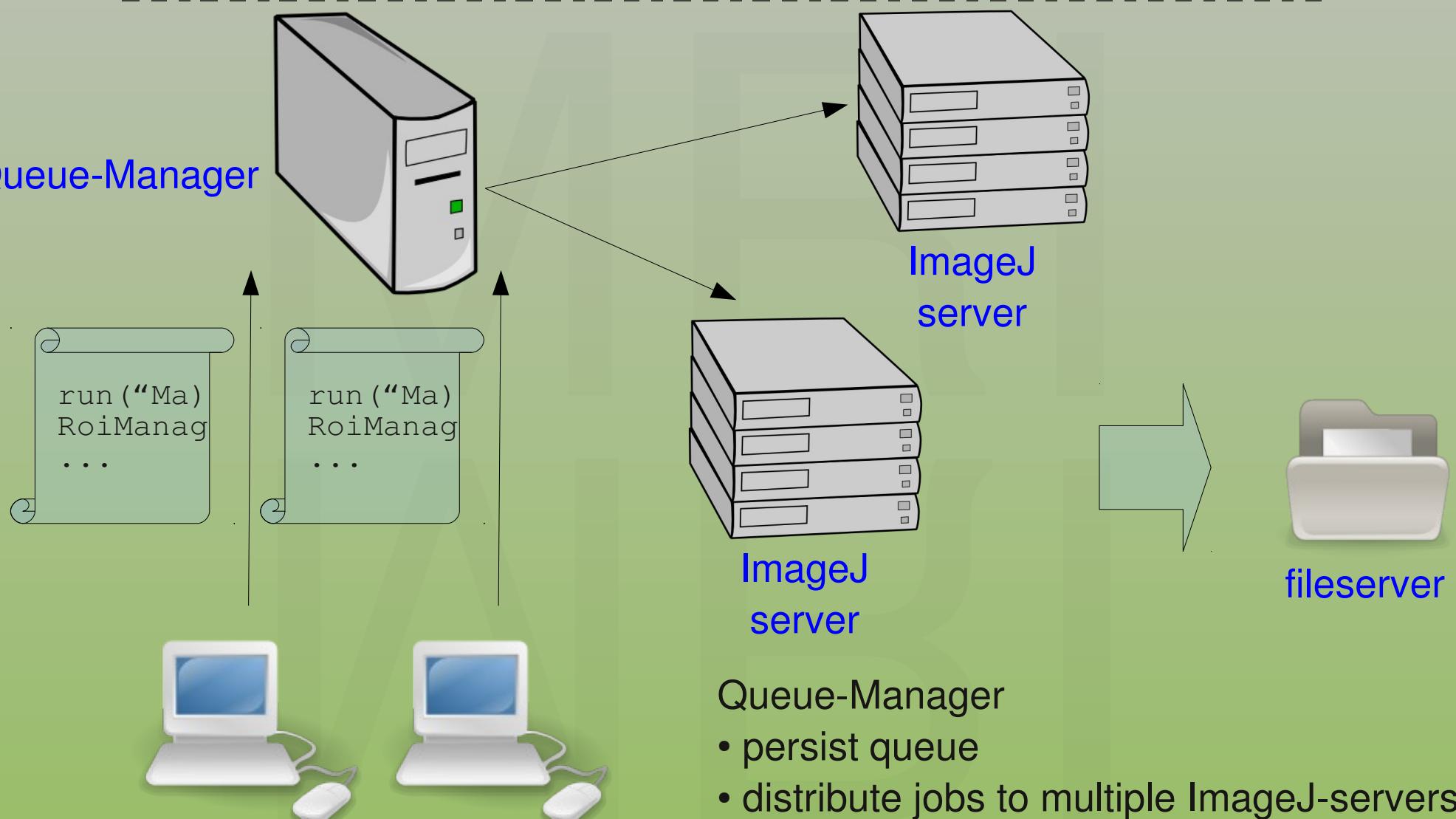
Queue-Manager
• persist queue
• distribute jobs to multiple ImageJ-servers

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Future Work

- support scripts
  - Javascript and other scripting languages from FIJI
  - Visual Scripting - MRI Cell Image Analyzer
  - ImageFlow - Dr. Kai Uwe Barthel
- handle other parameters in the same way as paths
  - gui input on client – send to server
- secure internet communication
  - authentication, secure sockets, certificates
- integrate into CICERO-image-database

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Thank you

■■

for your attention!

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and the ImageJ-community

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                                              Tran-Aupiais

Sylvain De Rossi, Virginie Georget, Alexandre Granier, Stephanie Vaudescal, ...

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