A Window to Galaxy

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Galaxy is a Linux Fan

- Galaxy is a great framework for Bioinformatics researchers.

- Which OS? Windows or Linux?
  - Great community support for Linux based Galaxy
  - Many RNA-seq analysis tools available for Linux
  - NO support for Windows-based Galaxy

  We chose Linux ☺

Mixed Workflow

- There are many tools that are developed and compiled for Windows, and therefore cannot be integrated into Galaxy workflows.
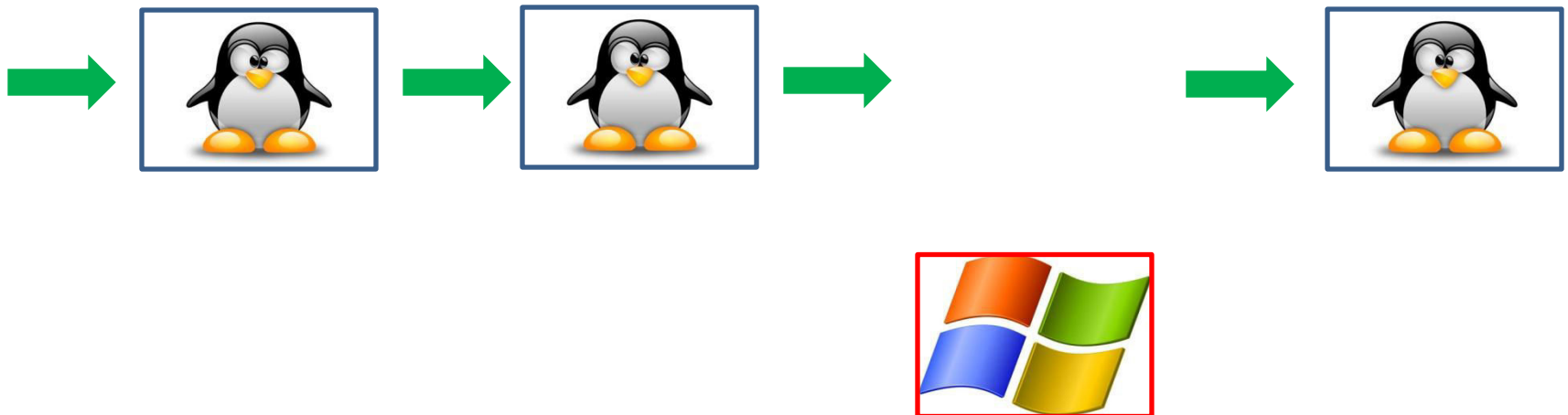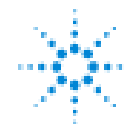

- Galaxy needs to embrace **all** developers (even if they made a mistake with the OS ☺) .

Galaxy @ Agilent

Within Agilent we have both Linux and Windows developers.

- Genomics:
  - RNA-seq
  - Most of the tools are executed on Linux platform
- Proteomics:
  - Mass spectrometry data analysis
  - **Agilent Spectrum Mill (Windows based)**

  http://www.chem.agilent.com/en-US/products-services/Software-Informatics/Spectrum-Mill/Pages/default.aspx

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The Problem

- Executable that refers to "Dynamic Link Libraries" (DLLs) will execute only on windows.

- Code written in .NET languages (C#, VB.net, etc) is compiled to a windows specific runtime

Do we really have to choose?

Existing Solution I - Mono

- Mono is a free and open source project led by Xamarin.

- Able to run Microsoft .NET applications cross-platform.

- Includes .NET Framework-compatible set of tools including:
  - C# compiler
  - Common Language Runtime

Existing Solution II - Wine

- Wine is a open source compatibility layer.
- Aims to allow computer programs written for Windows to run on Unix-like operating systems.
- It duplicates functions of a Windows computer by providing alternative implementations of the DLLs.

Drawbacks (personal experience)

Both are NOT supported by Microsoft

Mono:

- Partial support for the .NET features, such WPF, WCF, etc.
- In many cases a Mono recompilation of the source code is needed.
  - Additional work
  - Not always possible due to unavailability of the source code.

Wine:

- Only an old version exists at the Red Hat distribution.
- Problematic to install on remote machine without a display adaptor.
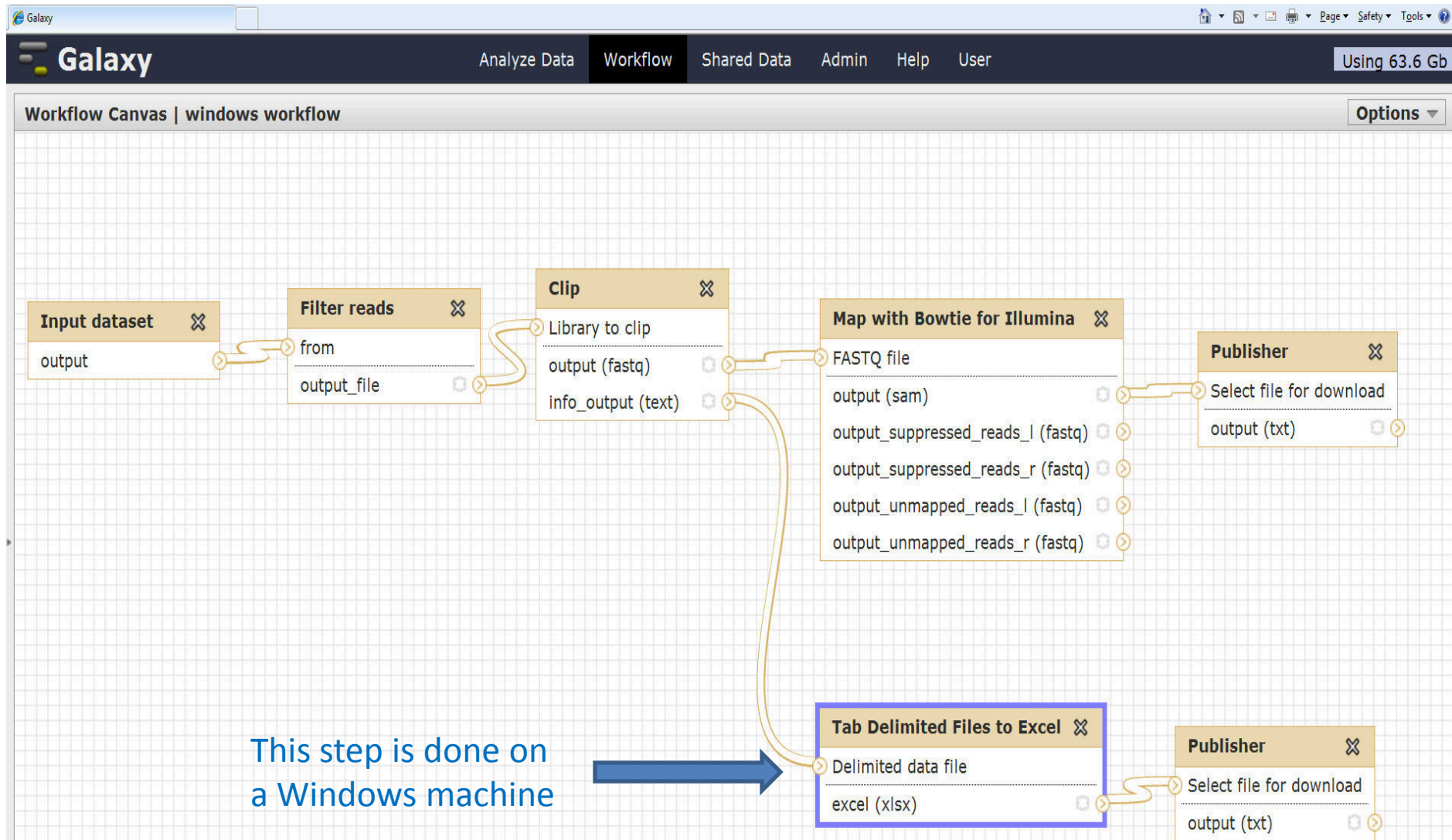- Requires Mono to execute .Net programs.

Our Proposed Solution

Goals:

- Enable running any Windows application from Linux

- Integrate Linux and Windows tools within the same galaxy workflow.

- Transparency of the integration to the Galaxy end user.

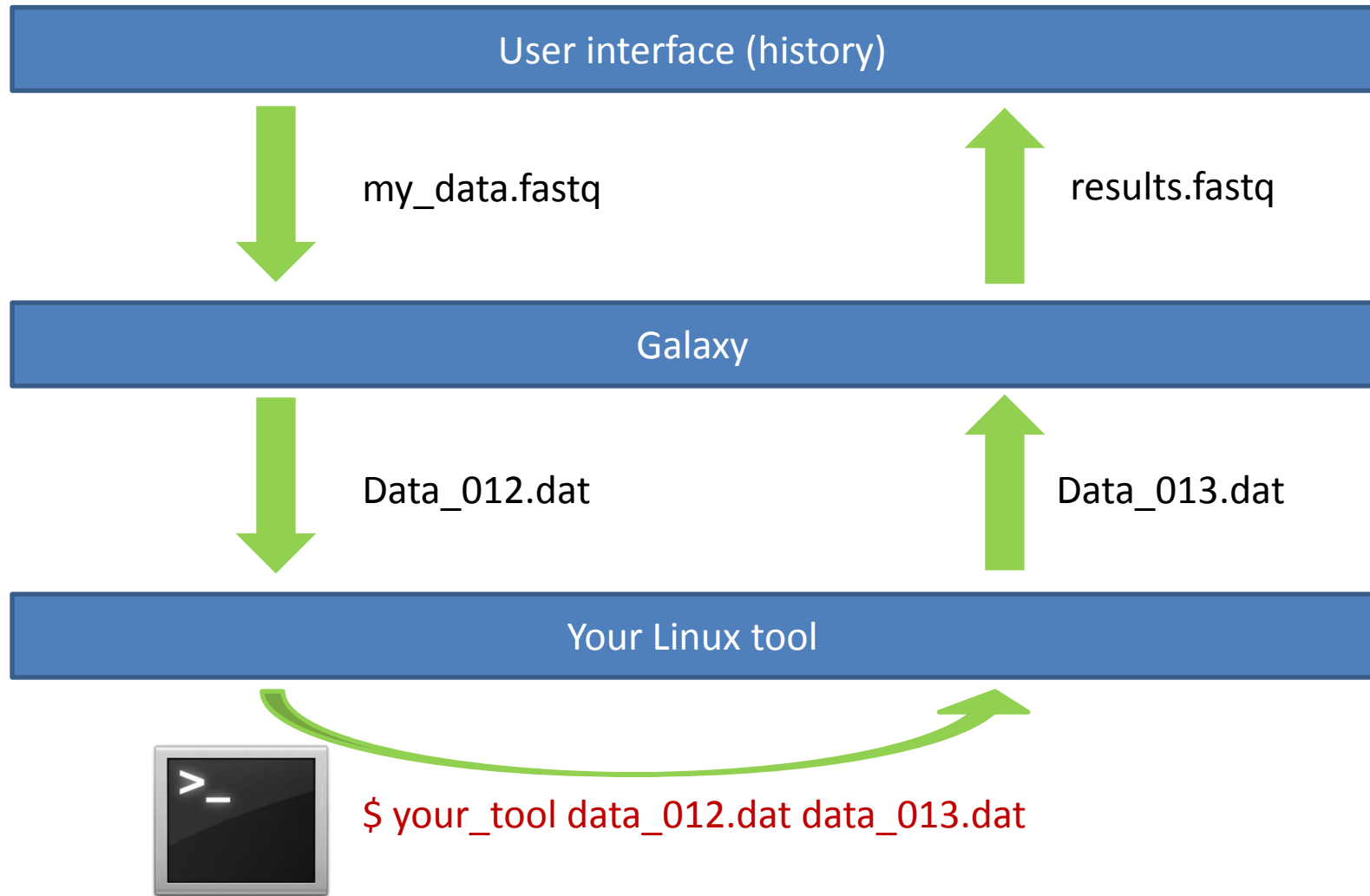# Example Hybrid Galaxy Workflow

A Window to Galaxy

Method:

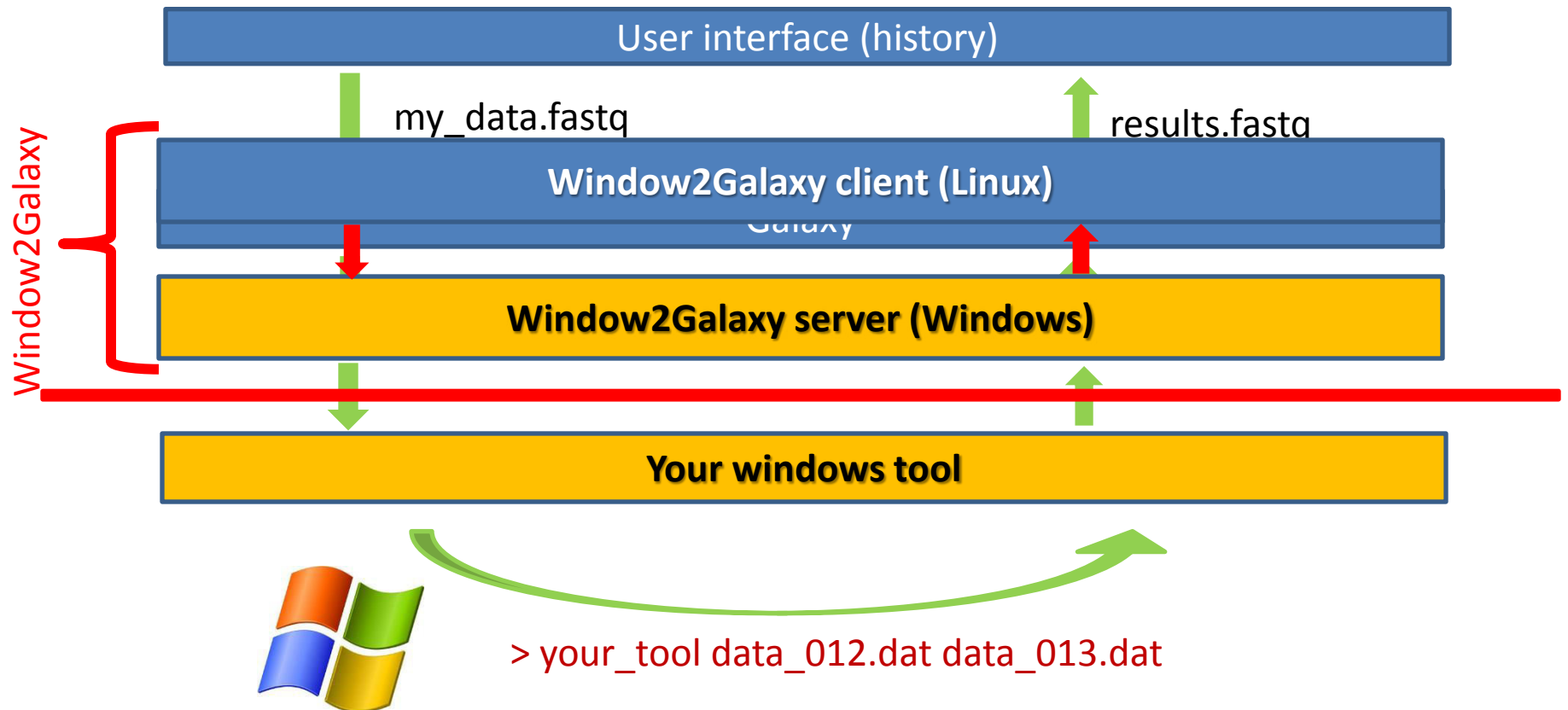Create a collaboration (relationship...) between two separate machines (Linux client and Windows server)

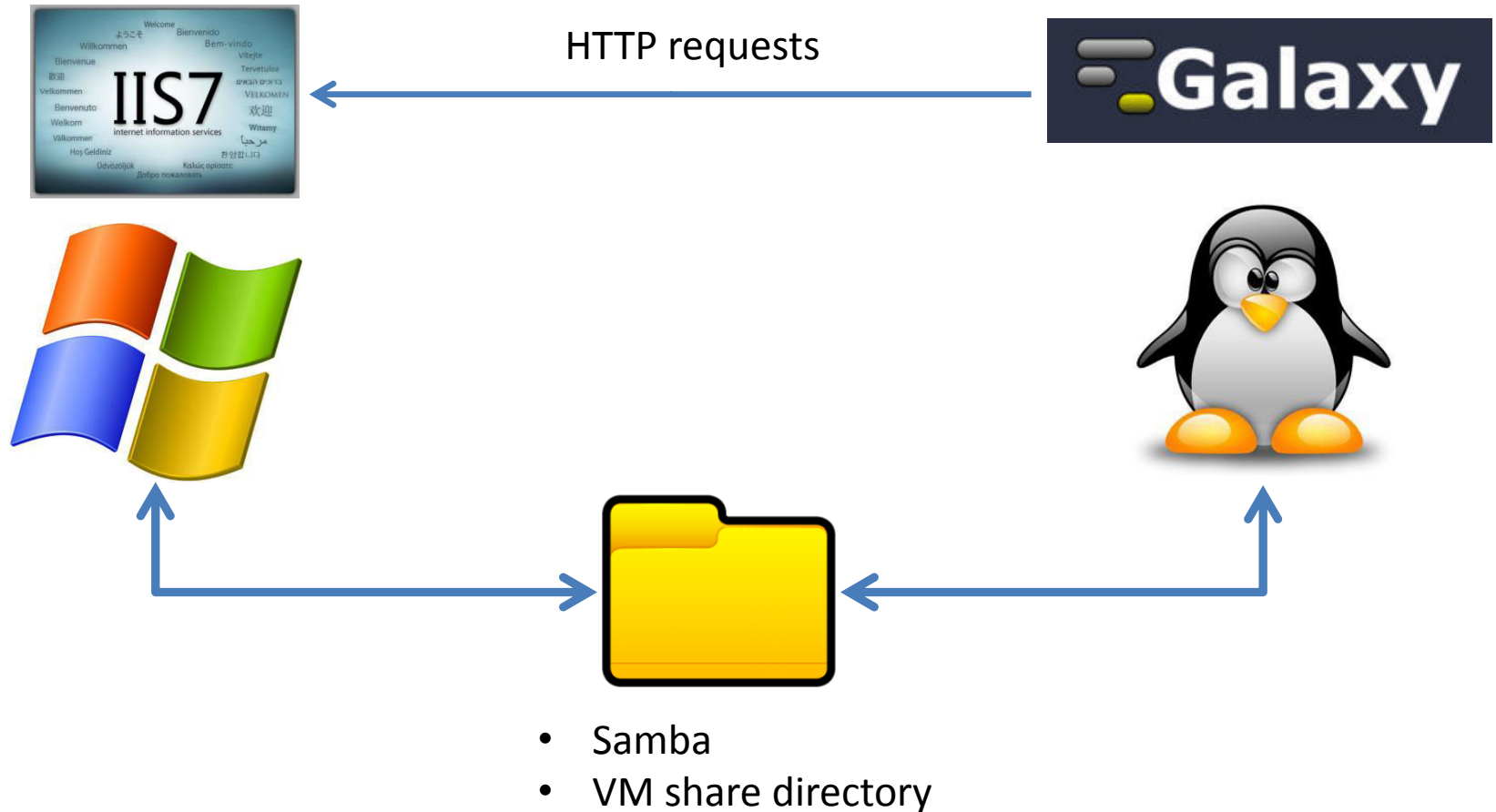- The "server" can be also a guest VM.

Galaxy Layers Model
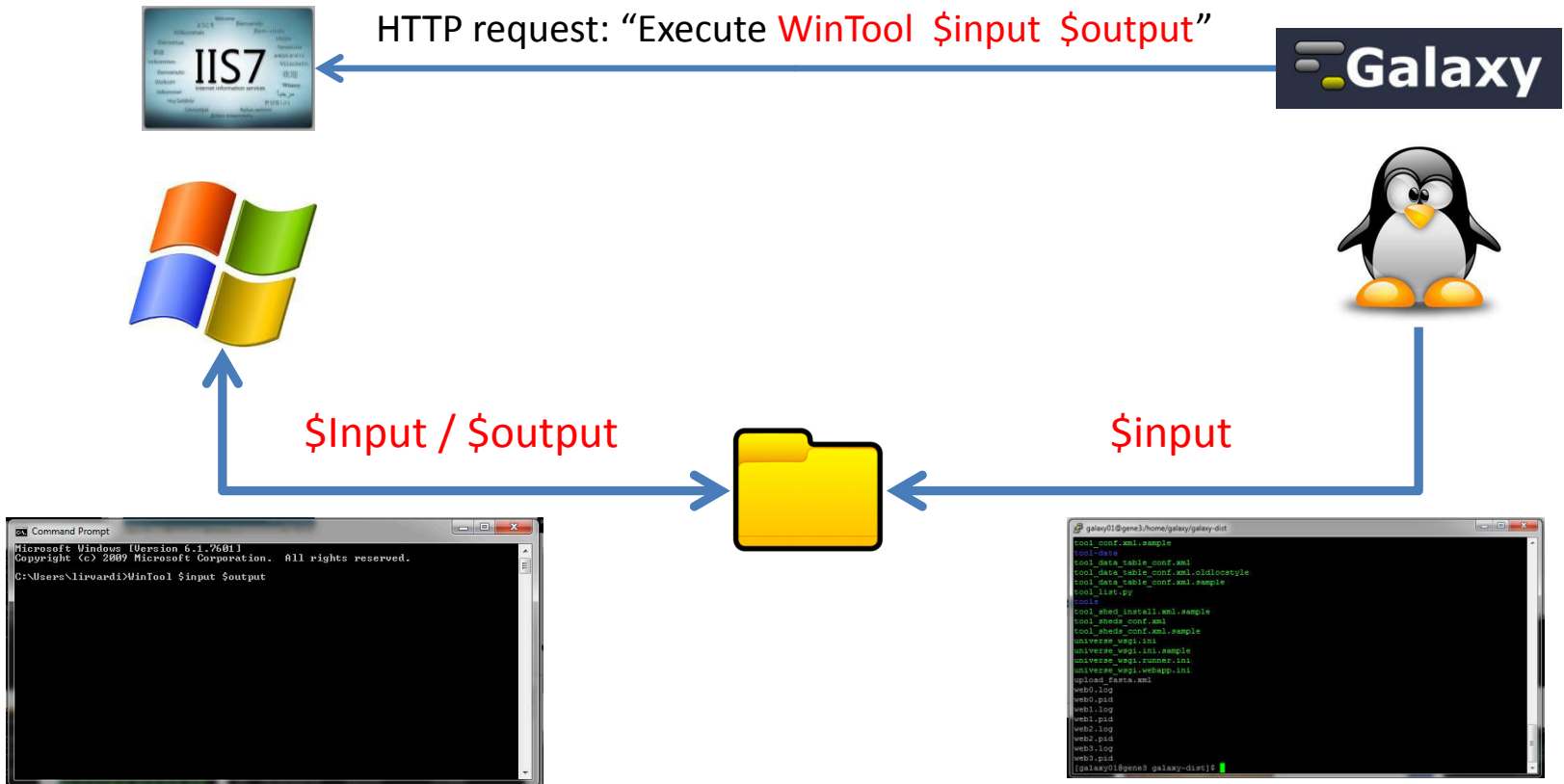
However, with a Windows-based Tool

User interface (history)

my_data.fastq

results.fastq

Window2Galaxy client (Linux)

Galaxy

Window2Galaxy

Window2Galaxy server (Windows)

Your windows tool

> your_tool data_012.dat data_013.dat

Window2Galaxy Implementation

HTTP requests

- Samba
- VM share directory

WinTool execution

"WinTool $input $output"

HTTP request: "Execute WinTool $input $output"

$Input / $output

$input

WinTool <Win_path>\$input <Win_path>\$output"

Window 2 Galaxy

WinTool <linux_path>/$input <linux_path>/$output"

WinTool Execution

HTTP request: Is job done?

Respond: Yes/No

$output

Standard Output Stream

Standard Error Stream
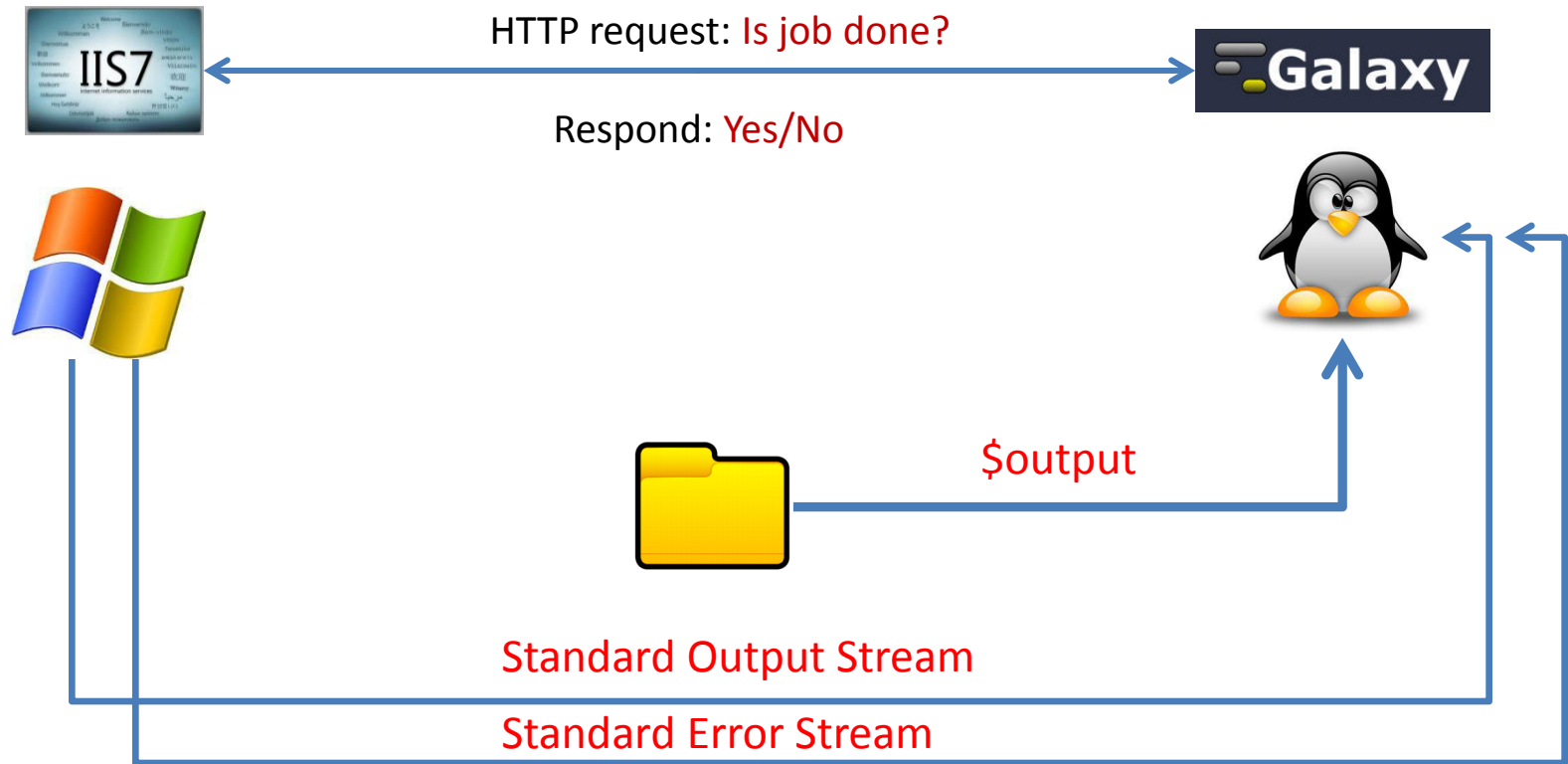
The Gory Details – Server Side

- Web service implemented on ASP.NET (Active Server Pages)
- Embedded in IIS7
- Window2Galaxy can execute any command (security breach?)
  - Job executed under IIS Worker (limited permissions) account
  - Users cannot integrate new tools and XML configuration without Galaxy administrator permissions
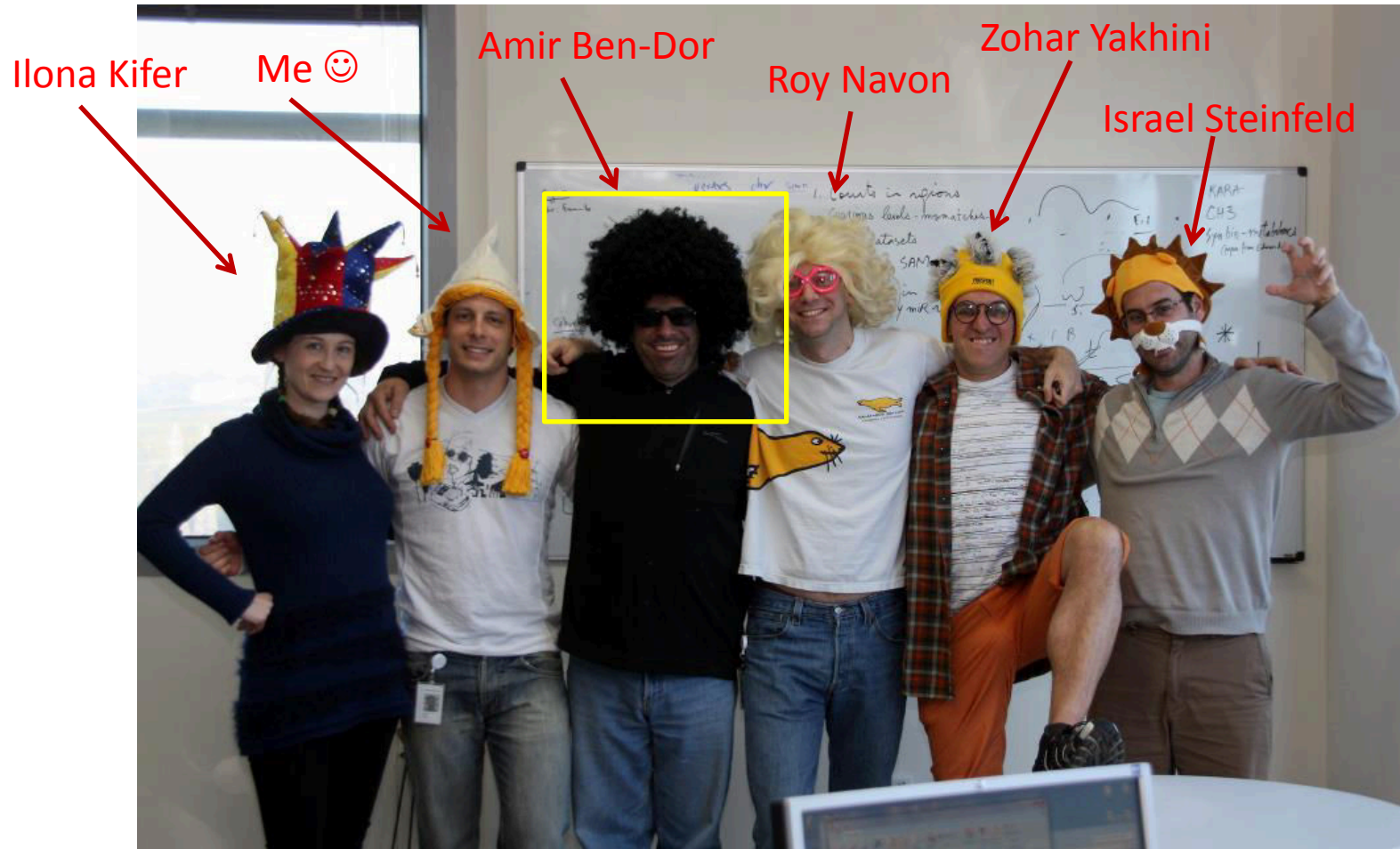
Easy Installation

- Prerequisites:
  - Server side: IIS7 installed
  - Setting up a shared directory
- Client installer (Linux side).
- Server Installer:
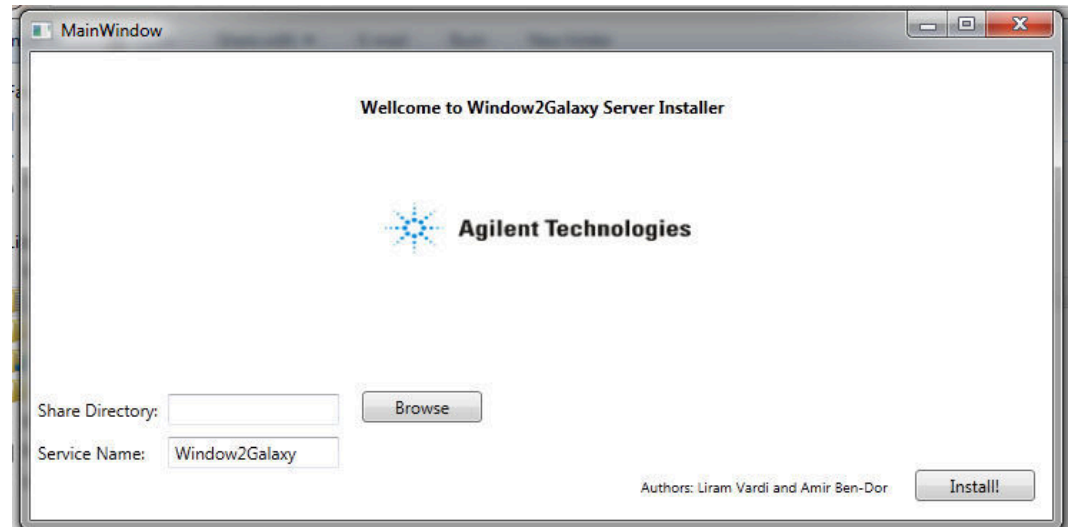
Summary

- Galaxy is a great framework (already said?).
- There are business and research needs to incorporate Windows-based tools into Galaxy workflows.
- Benefits of Window2Galaxy:
  - Enables running any Windows tool in a native fashion.
  - Totally transparent to the Galaxy end user
  - General mechanism for running Windows tools from Linux (not just for Galaxy users)
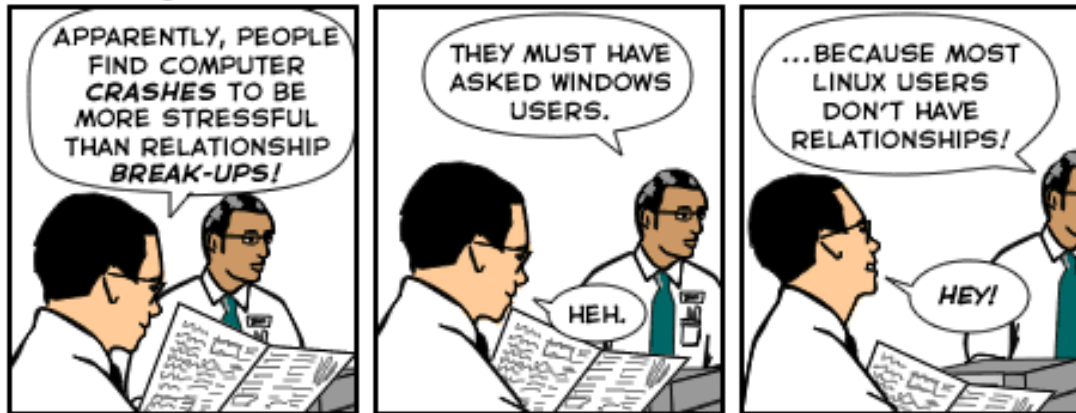
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Thank you!