

Leveraging Open Source for Geographically Dispersed Workflows

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The VPH Approach

- Estimate future outcomes by simulating personalized physiological models
- Personalization mostly comes from imaging, but demographics and lifestyle are considered, too
- Typically, in a study:
 - the same *procedural* workflow needs to be repeated for all the subjects
 - the workflow is carried out by researcher that are either more technically minded or with a more marked clinical-background
 - specialized clinicians oversee the final quality of the results

A Common Denominator

- A common characteristic of the projects to be presented is that

each of them assembles

open-source or open-source-derived components

to deliver innovative services

The sum is bigger than its components

the orchestration of the three projects
exemplifies
a template of a new way to provide
access to advanced solutions



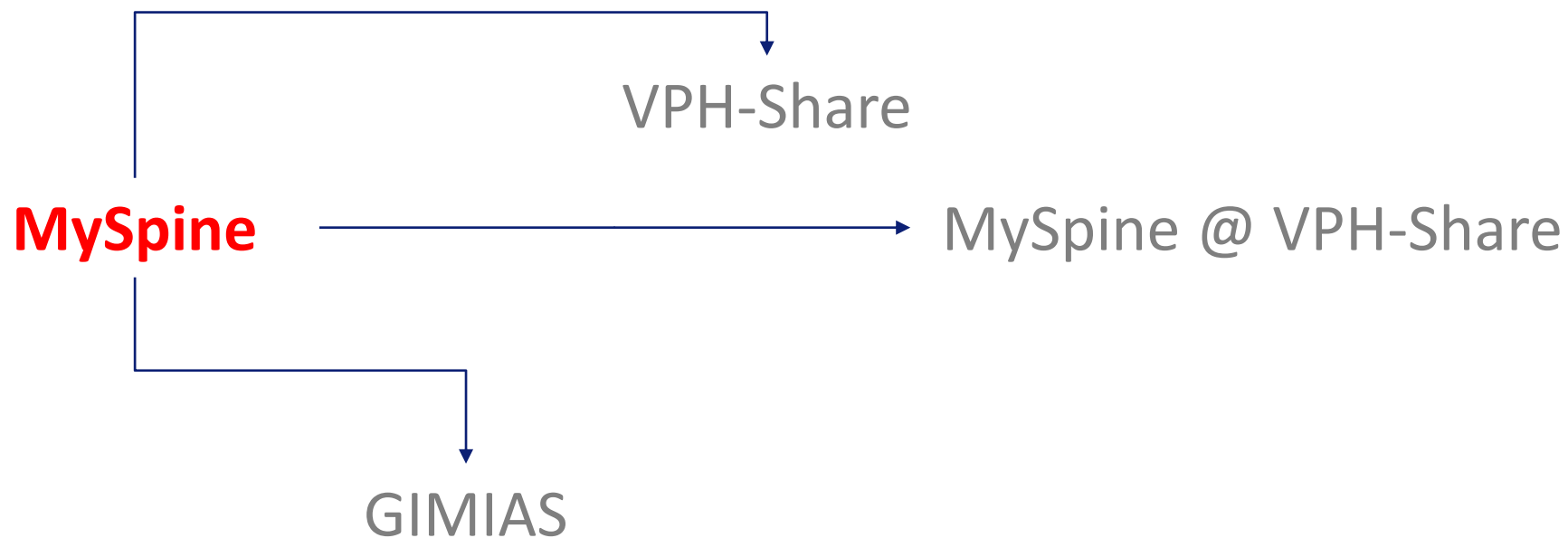
MySpine

GIMIAS



VPH-Share

*** Route Information ***



MySpine Motivation

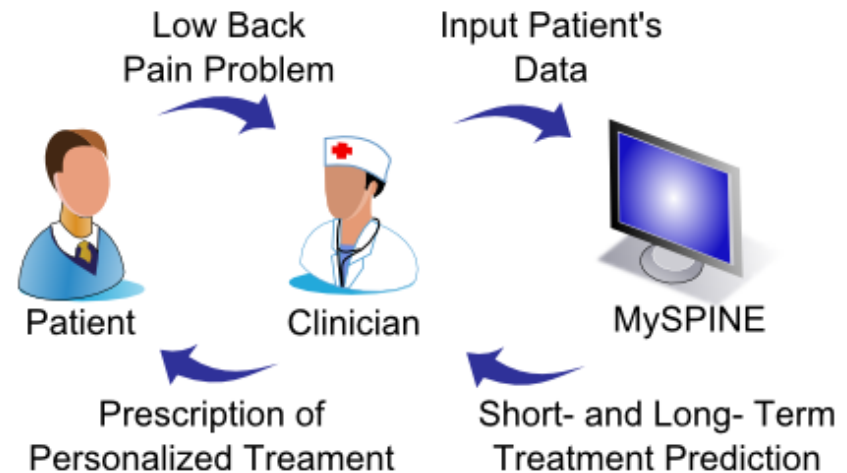


- Low back pain is a well-known and widely spread illness.
- Prevalence estimates for chronic low back pain between 6 and 11% (and annual direct cost of low back pain of 7.000 € per person)
- Billions of Euro are spent each year in Europe on treating this disorder.

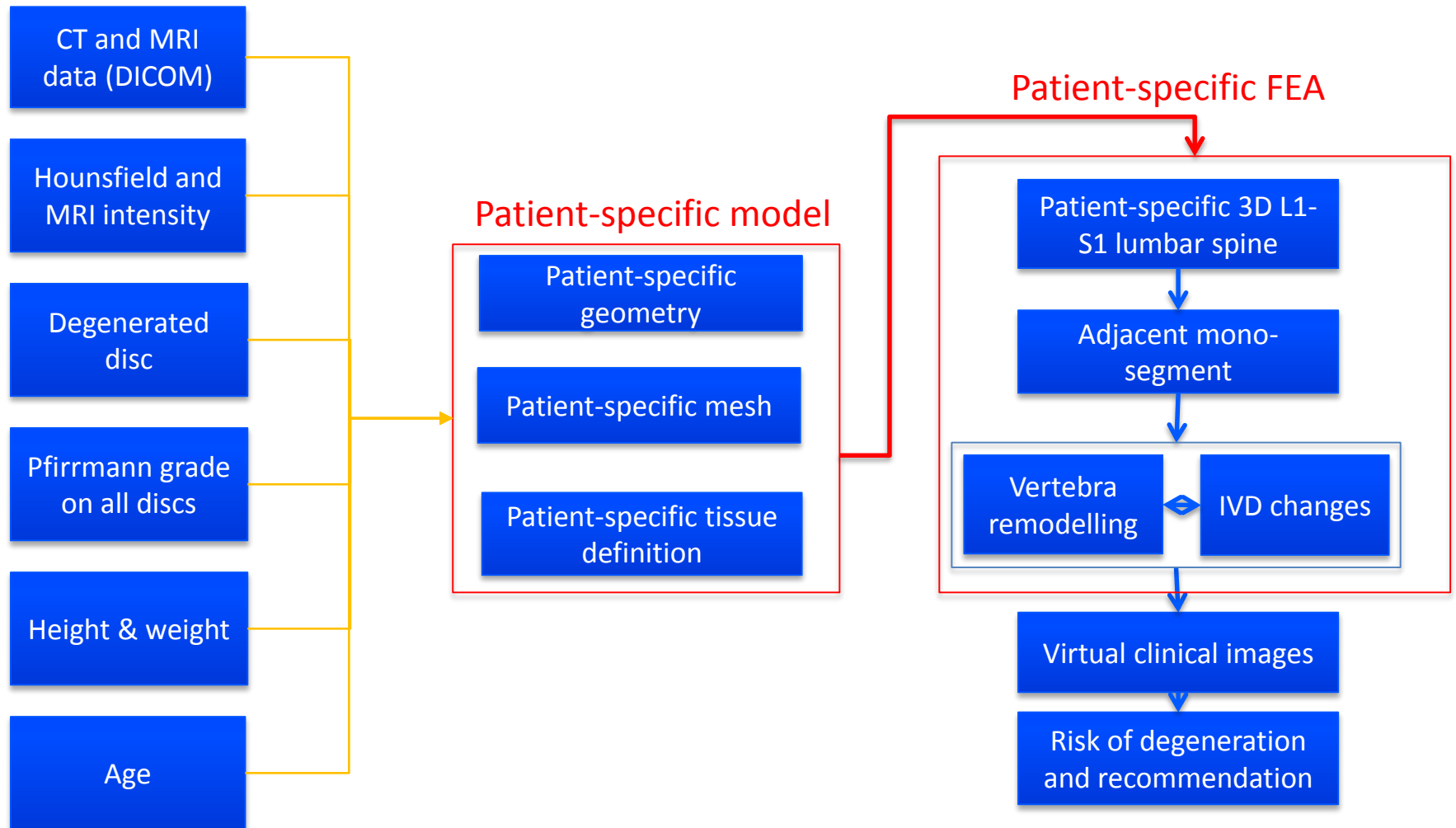
(Juniper et al. 2009)

MySpine Goals

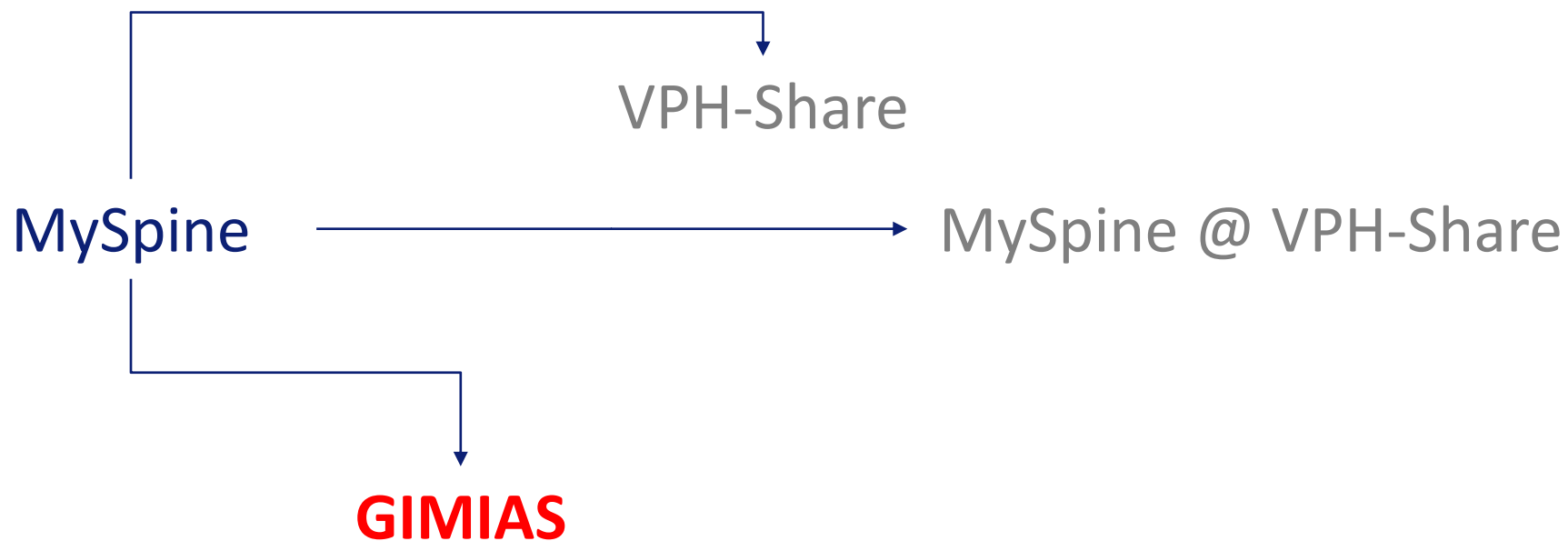
- Aims to create a clinical predictive tool to provide clinicians with patient-specific biomechanical and mechanobiological analysis.
- This tool will help to determine the best patient specific treatment for low back pain.
- The project will focus on disc degeneration pathology although the developed prototype system may be able to analyze other spinal pathologies as well.



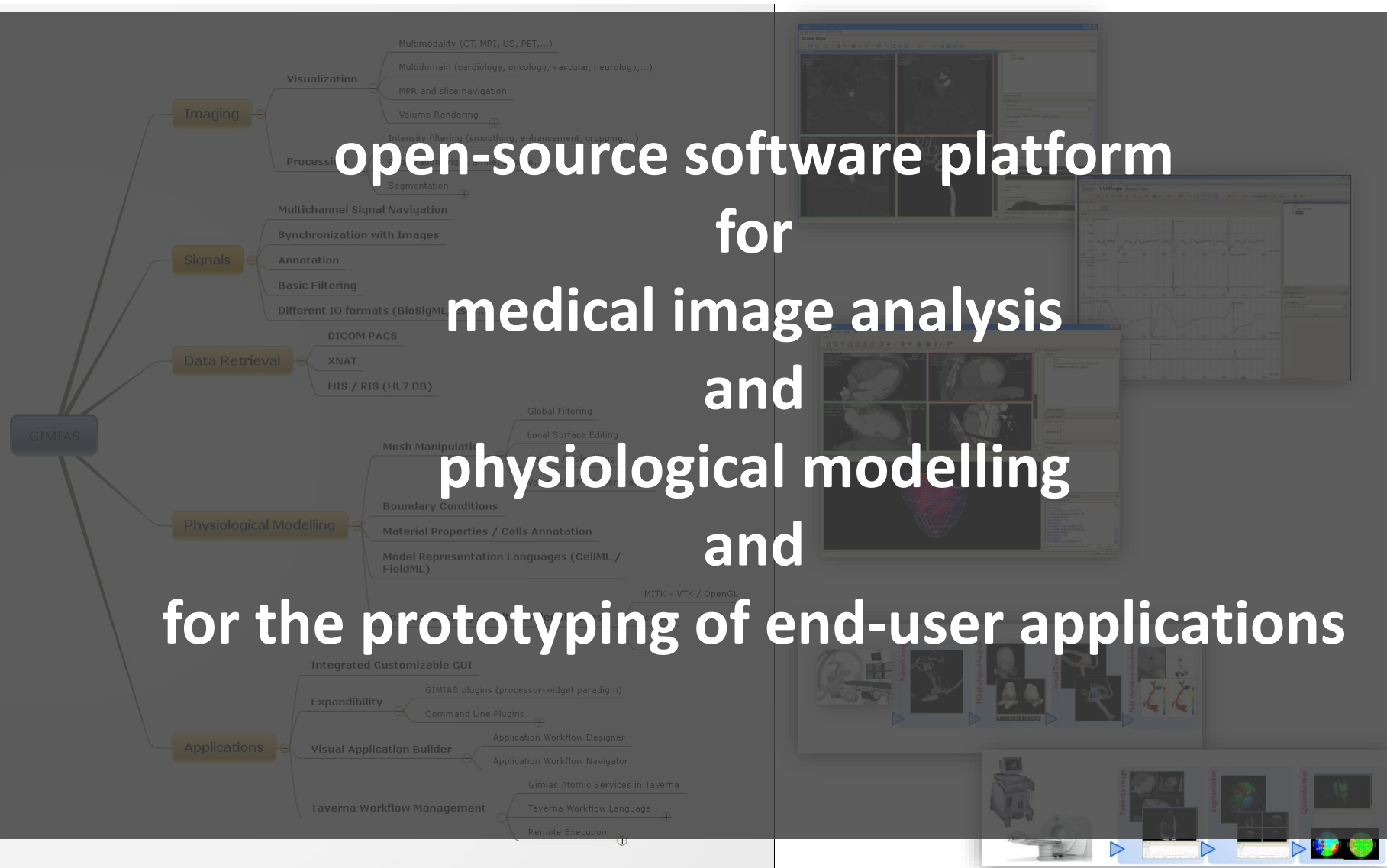
MySpine Data Flow



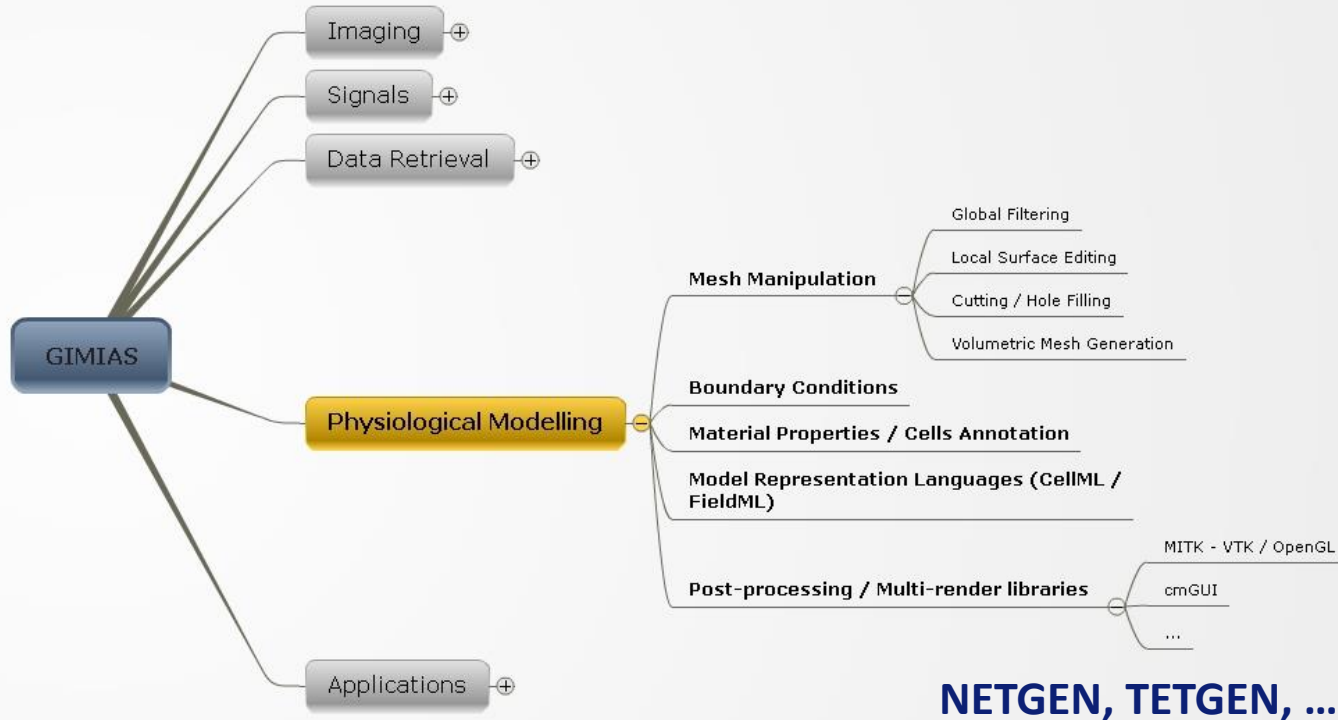
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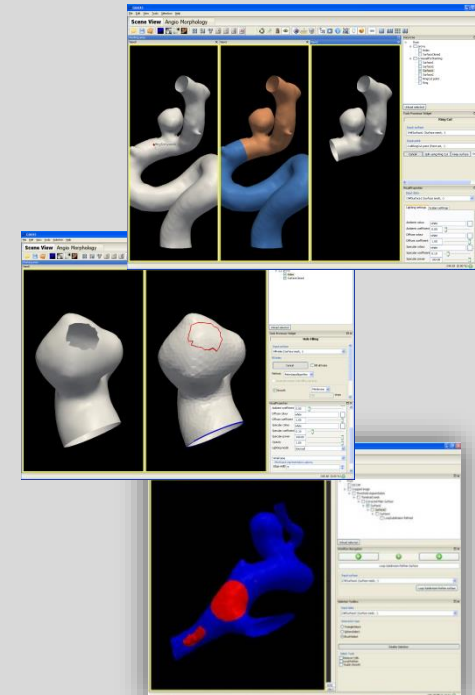
GIMIAS



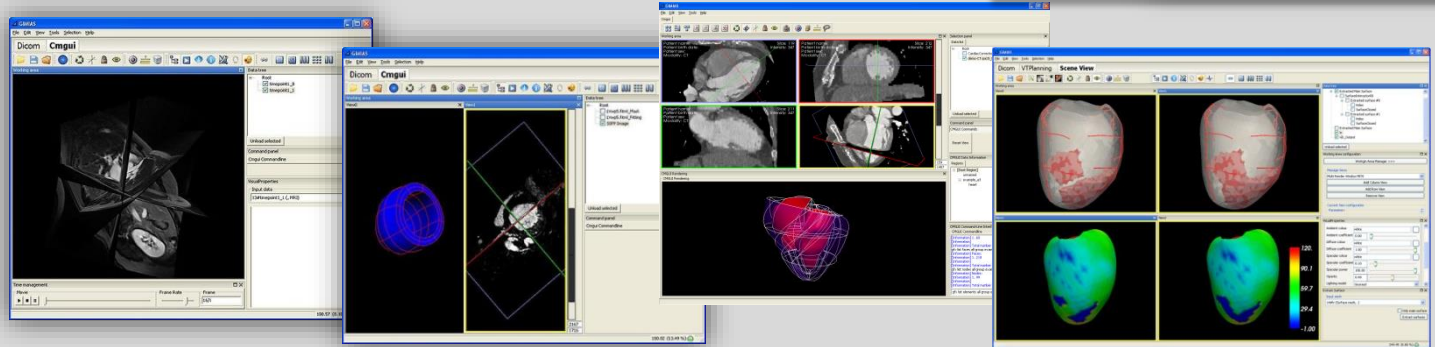
GIMIAS – Physiological Modelling



Mesh Manipulation

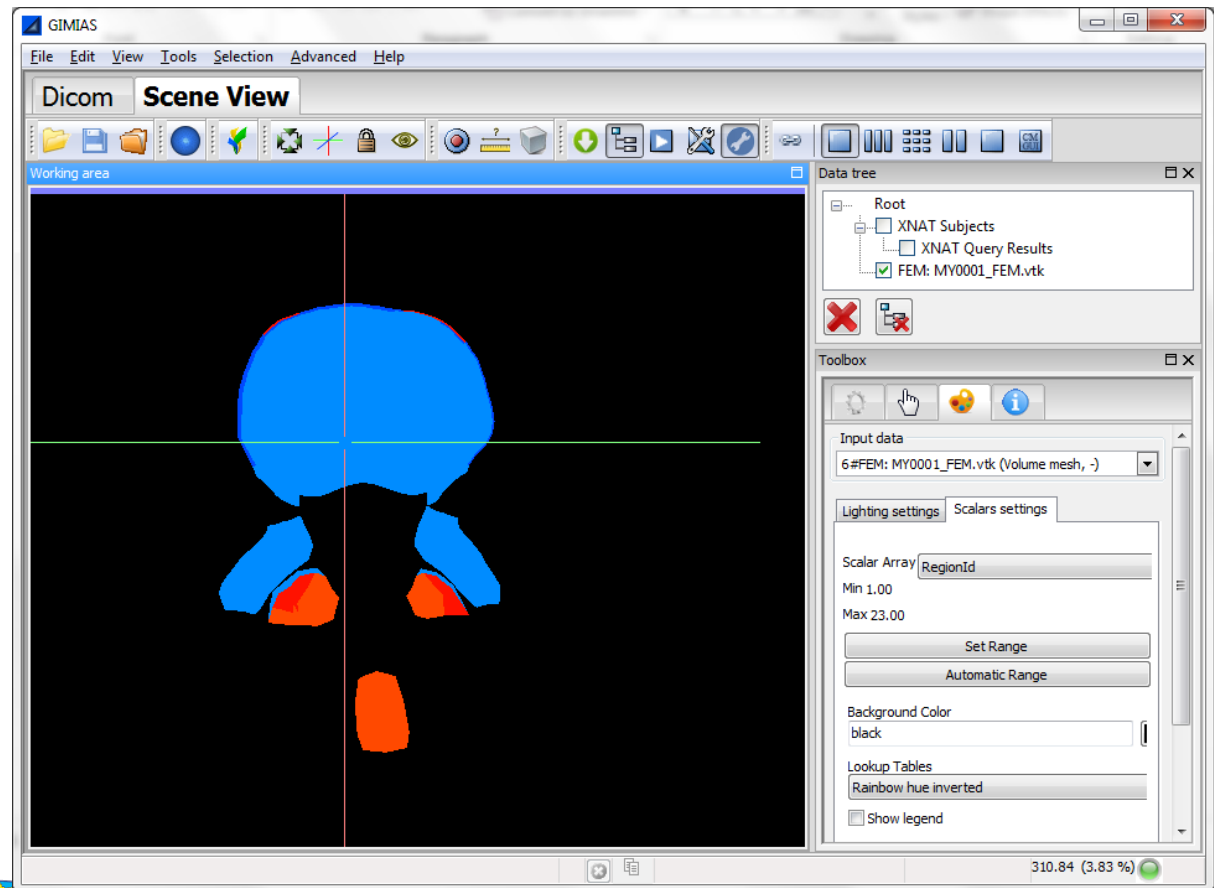


Post-processing Multi-render libraries



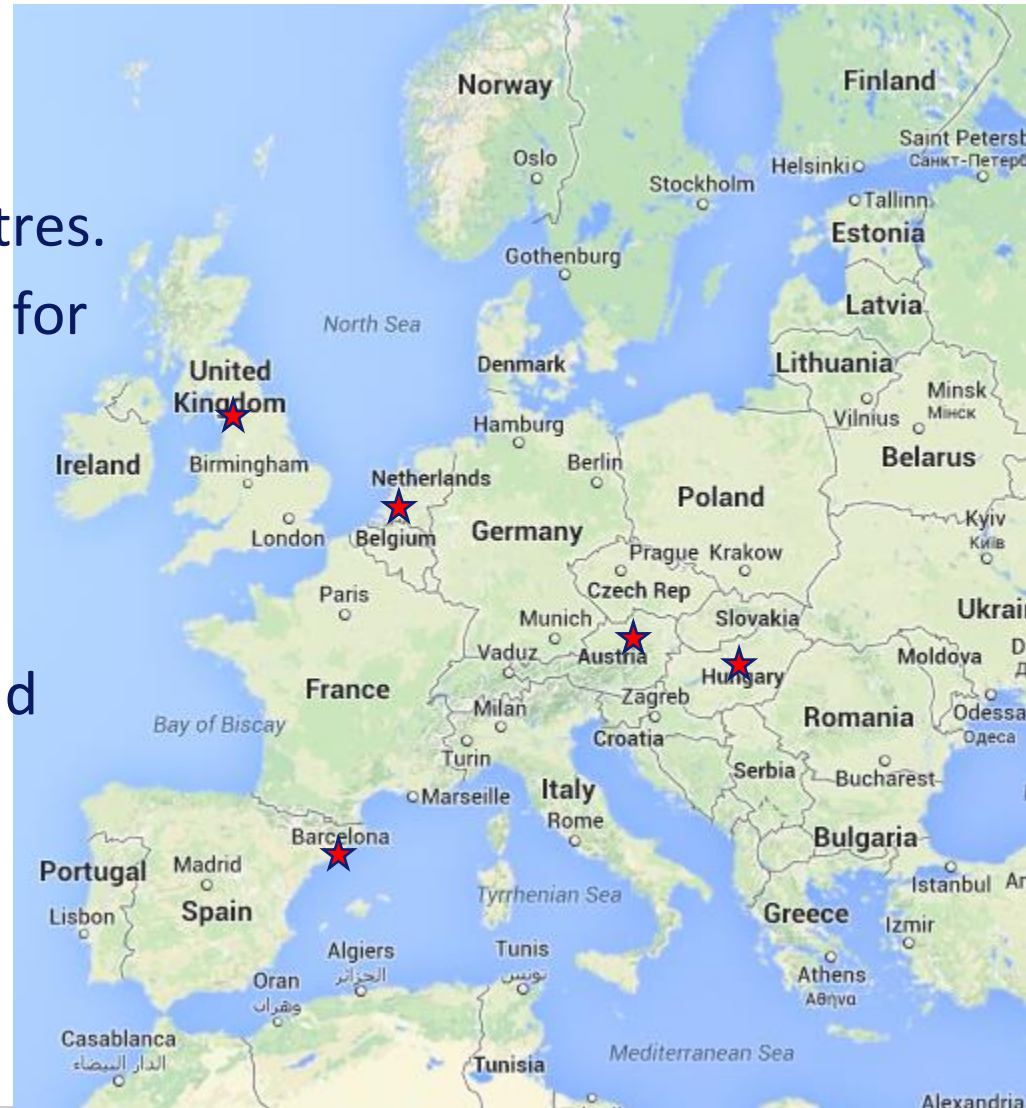
GIMIAS 4 MySpine

- Proper handling of unstructured grids
- Enhanced **XNAT** connectivity

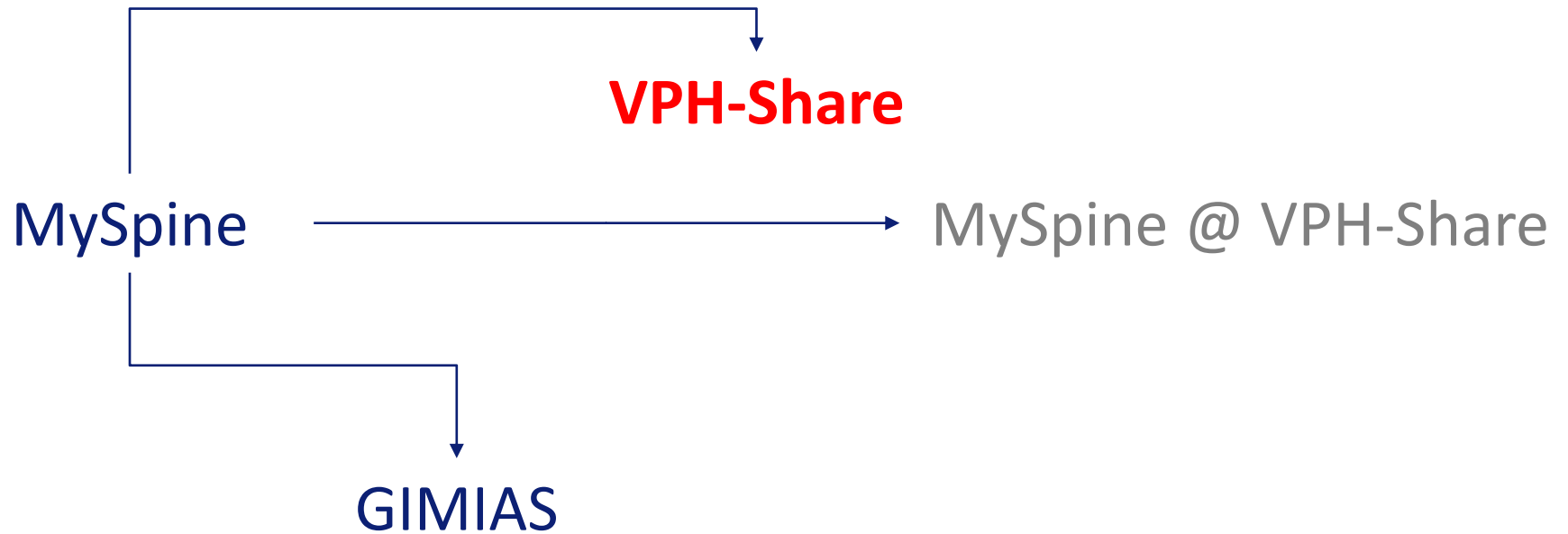


MySpine goals & needs

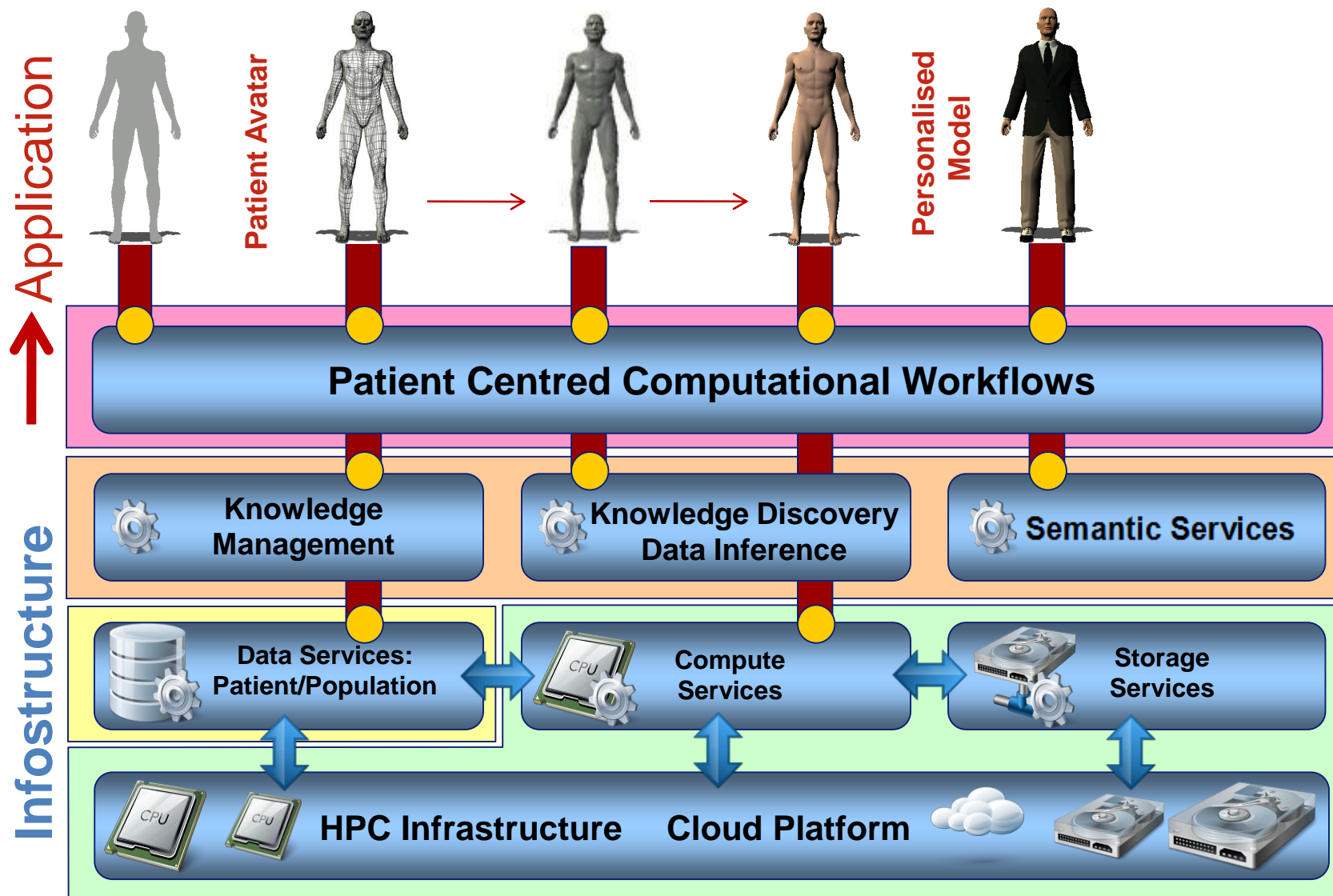
- Run 250 lumbar spine reconstructions in 3 weeks involving 6 Partners, 4 HPC facilities and 2 Medical centres.
- Provide a clinical prototype for validation by the medical centres and the project advisory board.
- Facilitate continuous deployment of upgrades and fixes to the users



Route Information

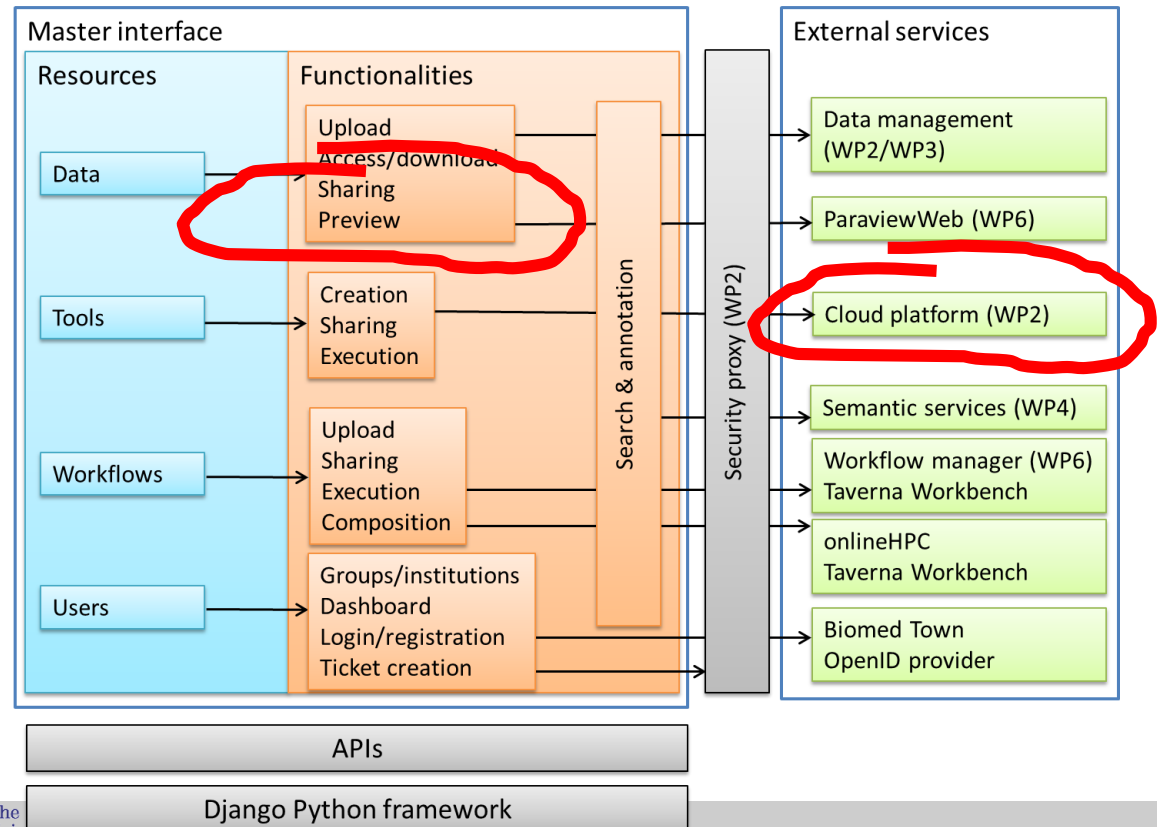


VPH-Share Overview



VPH-Share Infostructure

- VPH-Share flexibility comes from a rich support layer (the infostructure) where services are made accessible to user through the web-based Master Interface



VTK File Preview in LOBCDER

VPH-SHARE Help | About Hi, master!

DATA APPLICATIONS WORKFLOWS SEARCH

home | lobcder

Directory name Create directory

View slice MOVE mouse & press LEFT button: rotate, MIDDLE button: pan, RIGHT button: zoom Options

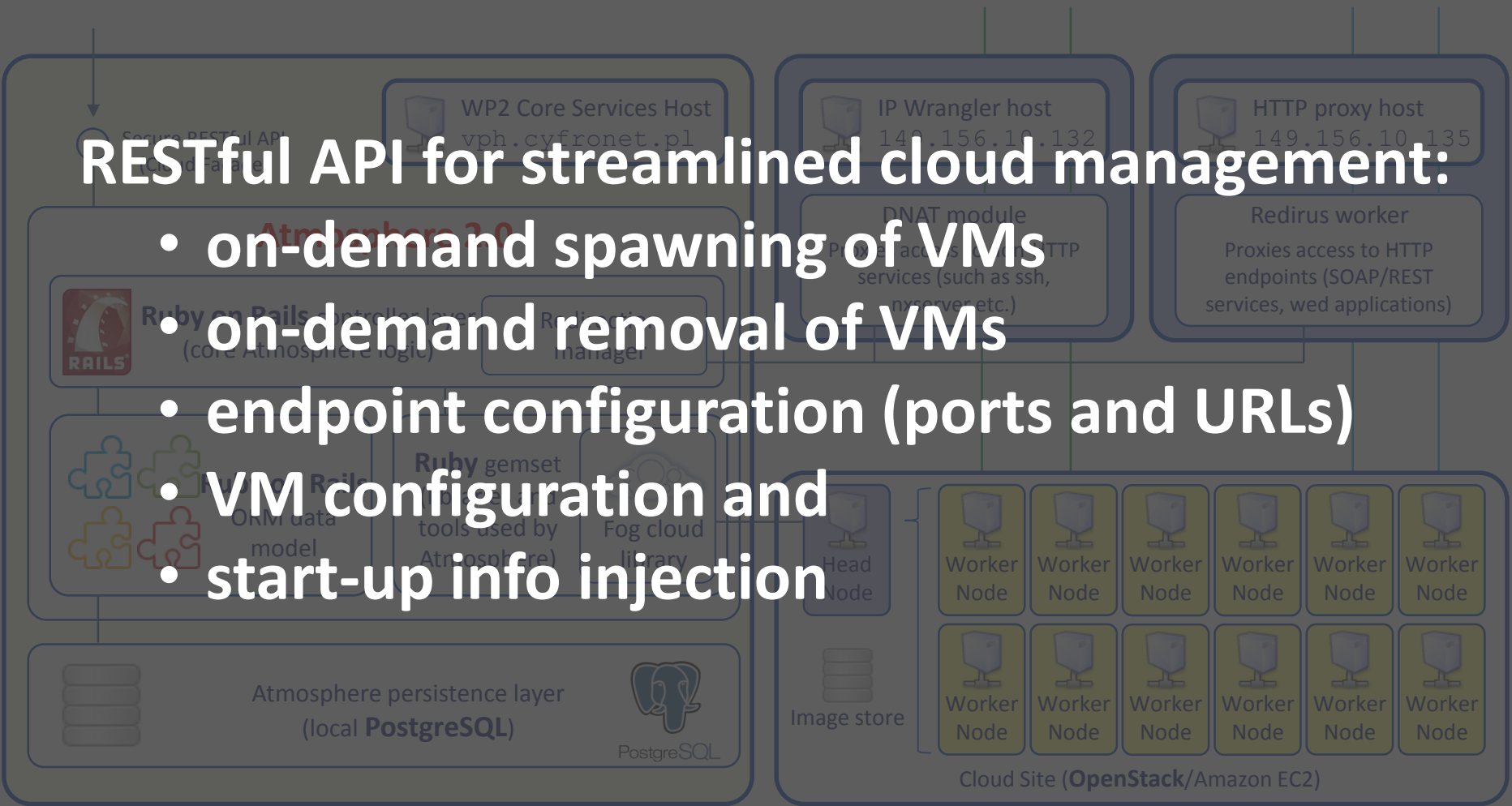
Name	Owner	Modified	Size (B)	Actions
06e4cb7b-a391-4d66-84a5-530b53814252	demo1	13 Mar 2014	0	
0ce0cd5e-19e3-48e6-962b-c3704dbd381b	demo1	23 Mar 2014	0	
1c35b141-43ea-4434-9d96-c6d98bd64c71	demo1	11 Mar 2014	0	

ParaView Web

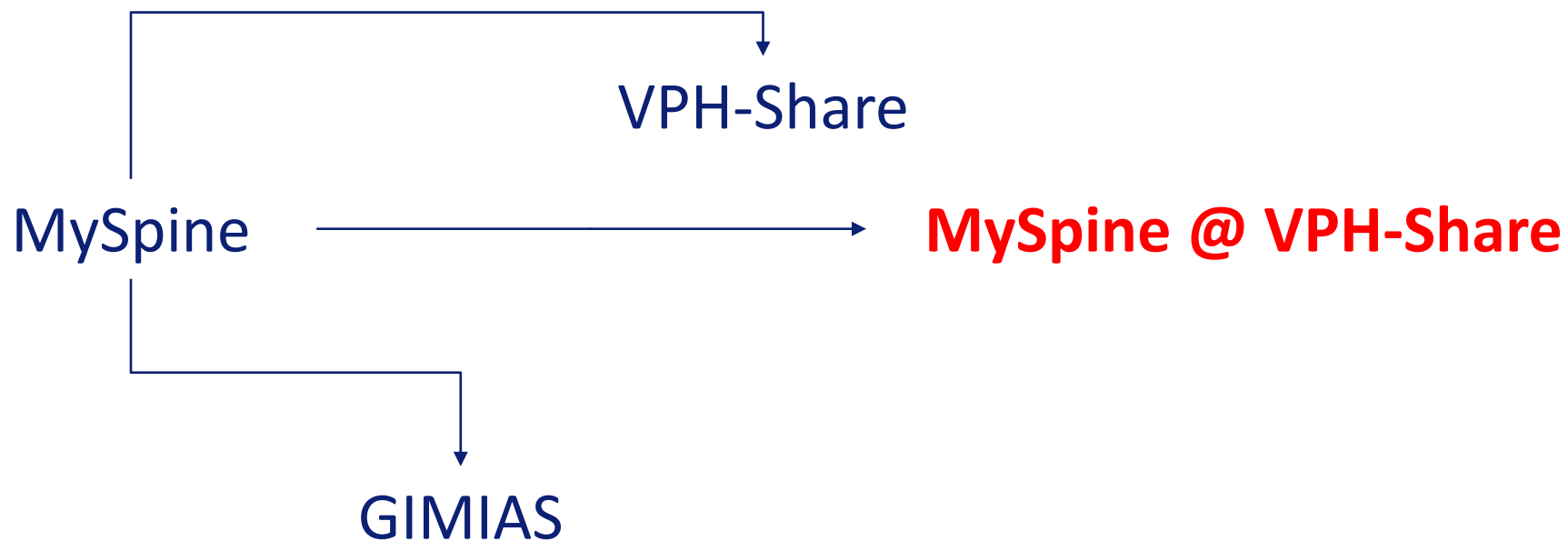
VPH-Share Cloud Services

RESTful API for streamlined cloud management:

- on-demand spawning of VMs
- on-demand removal of VMs
- endpoint configuration (ports and URLs)
- VM configuration and start-up info injection



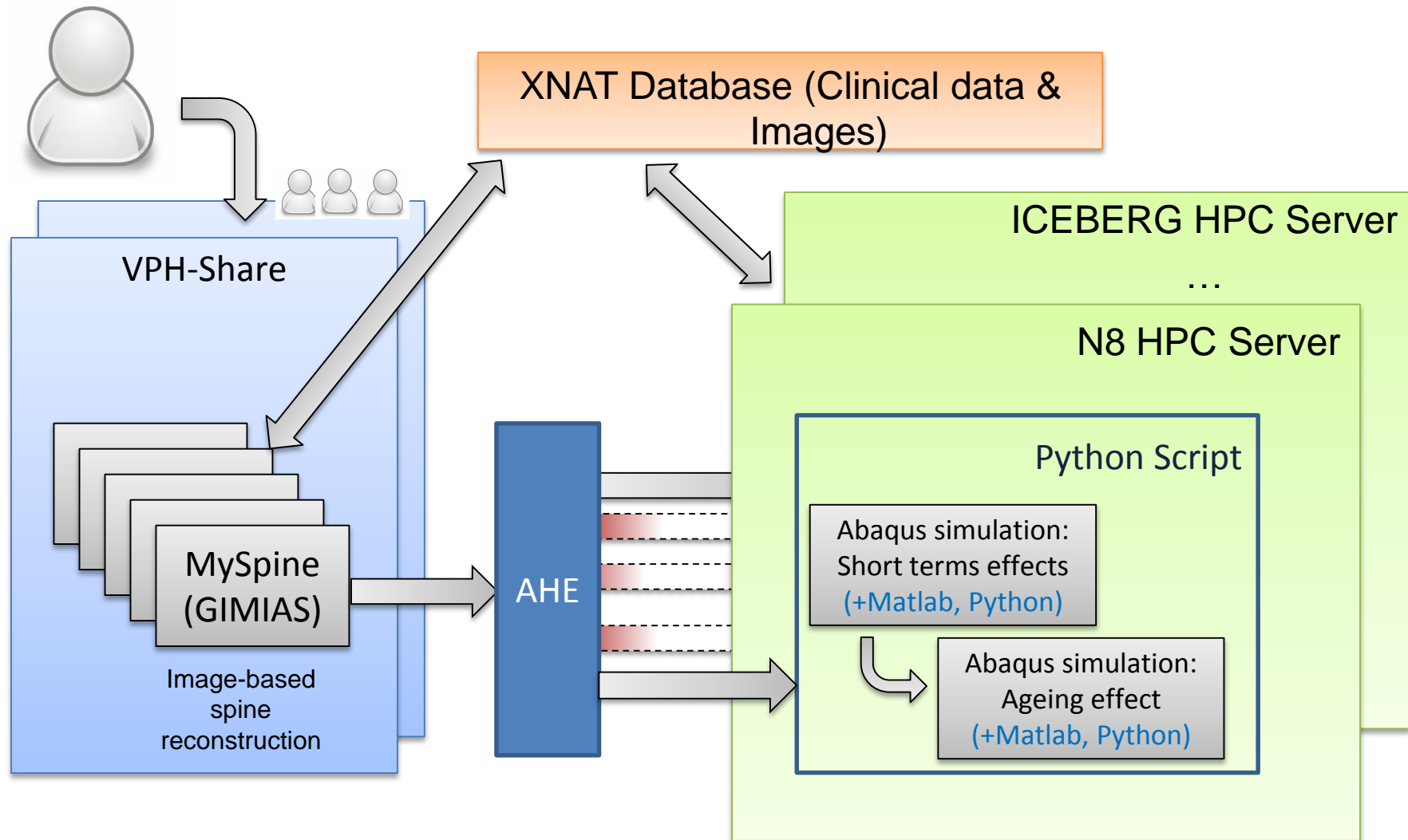
Route Information



Expected Outcomes of MySpine in VPH-Share

- MySpine workflow made available at anytime, in anyplace to all partners
- Deployment of software upgrades automatically accessible to all partners
- Facilitate connectivity between MySpine software platform and HPC facilities

MySpine@VPH-Share Main Components

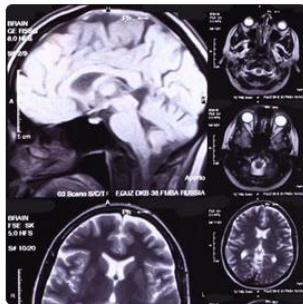


Starting MySpine@VPH-Share: application selection (1/3)



WELCOME TO THE MASTER INTERFACE!

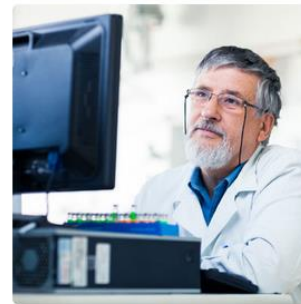
VPH-Share is an online environment for the development, construction and storage of biomedical workflows. It is designed to help researchers, clinicians and software developers share resources - data and tools – to build workflows quickly and easily.



BETA USERS PROGRAM



WORKSPACE



GROUPS



SEARCH

Starting MySpine@VPH-Share: application selection (2/3)

The screenshot shows the VPH-SHARE web application interface. The header is blue with a grid pattern and contains the VPH-SHARE logo on the left and navigation links for 'Help | About' and 'Hi, Peter!' on the right. Below the header is a white navigation bar with four tabs: 'DATA', 'APPLICATIONS', 'WORKFLOWS', and 'SEARCH'. The 'APPLICATIONS' tab is selected and highlighted. Below the navigation bar, there are links for 'home | tools' and a set of buttons for 'Applications', 'Workflows', and 'My Applications'. The 'Applications' button is highlighted in blue. Below this, there is a message 'No applications' in a grey box and a green button labeled 'Start new application' which is circled in red.

Starting MySpine@VPH-Share: application selection (3/3)

Start new application

AHE

MySpine r20 AHE (Application Hosting Environment)
Matched Flavor: M3 Extra Large
(\$0.5320 per hour)

1. Download of CT/MR of same session together in one click on Download button. 2. Upload of Segmentation and Alignment meshes(5 files) along with the FEM(5 files) upload. 3. Run simulation modified - included the session number of MR/CT scans as one of the arguments passed to run the simulation script. 4. AhePlugin - Run Simulation using Application Hosting Environment (AHE). 5. The "Tools/Segmentation/Manual Correction of Meshes" is available in the workflow mode. Respective MySpine.xml workflow file should be added at C:\Users\
(Username)\AppData\Roaming\gimias\v1.5_MySpine\Workflows

Pick initial configuration:
blank configuration

▶ Start selected Cancel

▶ Start selected Cancel

Starting MySpine@VPH-Share: cloud instantiation (1/2)

The screenshot shows the VPH-SHARE web interface. At the top, there is a navigation bar with 'VPH-SHARE' in large white letters on a blue grid background. To the right of the logo are links for 'Help | About' and a user greeting 'Hi, Peter!'. Below the navigation bar is a secondary menu with 'DATA', 'APP', and 'SEARCH' tabs. A breadcrumb trail shows 'home | tools'. Below this are navigation buttons for 'Applications', 'Workflows', and 'My Applications'. The main content area displays a table with the following data:

Name	IP	Location	Status	Charge	Actions
MySpine r21 AHE		Amazon	build	\$0.13	

Annotations on the screenshot include:

- A blue thought bubble labeled 'Amazon cloud' pointing to the 'Location' column.
- A blue thought bubble labeled 'Being Instantiated' pointing to the 'Status' column.
- A red oval around the 'IP' column header.
- A red oval around the 'build' button in the 'Status' column.
- A blue thought bubble labeled 'Initial Cost' pointing to the '\$0.13' value in the 'Charge' column.

Starting MySpine@VPH-Share: cloud instantiation (1/2)

The screenshot displays the VPH-SHARE web interface. At the top, there is a navigation bar with 'VPH-SHARE' and user information 'Hi, Juan!'. Below this are tabs for 'DATA', 'APPLICATIONS', 'WORKFLOWS', and 'SEARCH'. The 'APPLICATIONS' tab is active, showing a table of application hosting environments. One entry is 'MySpine r20 AHE (Application Hosting Environment)' with IP '54.216.87.194', location 'Amazon', status 'active', and charge '\$0.53'. Below the table, there are sections for 'Web Applications' (No web applications), 'WS/REST Services' (No services), and 'Other services' (RDesktop at 54.216.87.194:3389). A 'Start new application' button is visible. A red oval highlights a list of workflow steps: 1. Download of CT/MR or same session together in one click on Download button. 2. Upload of Segmentation and Alignment meshes(5 files) along with the FFN(5 files) upload. 3. Run simulation modified - included the session number of MR/CT scans as one of the arguments passed to run the simulation script. 4. AhePlugin - Run Simulation using Application Hosting Environment (AHE). 5. The "Tools/Segmentation/Manual Correction of Meshes" is available in the workflow mode. Respective MySpine.xml workflow file should be added at C:\Users\((Username)\AppData\Roaming\gimias\v1.5_MySpine\Workflows. A blue cloud annotation 'Already started' points to the application row. Another blue cloud 'Application Upgrades' points to the 'Other services' section. A third blue cloud 'RDP is enabled' points to the RDesktop service. A yellow banner at the bottom states: 'Cloud costs shown, are indicative only. For the duration of the VPH-Share project, all cloud costs will be met by the project.'

Name	IP	Location	Status	Charge	Actions
MySpine r20 AHE (Application Hosting Environment)	54.216.87.194	Amazon	active	\$0.53	[Menu] [Power]

1. Download of CT/MR or same session together in one click on Download button. 2. Upload of Segmentation and Alignment meshes(5 files) along with the FFN(5 files) upload. 3. Run simulation modified - included the session number of MR/CT scans as one of the arguments passed to run the simulation script. 4. AhePlugin - Run Simulation using Application Hosting Environment (AHE). 5. The "Tools/Segmentation/Manual Correction of Meshes" is available in the workflow mode. Respective MySpine.xml workflow file should be added at C:\Users\((Username)\AppData\Roaming\gimias\v1.5_MySpine\Workflows

Web Applications
No web applications

WS/REST Services
No services

Other services
RDesktop 54.216.87.194:3389
Start new application

Cloud costs shown, are indicative only. For the duration of the VPH-Share project, all cloud costs will be met by the project.

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Connecting to MySpine@VPH-Share

54.216.87.194:3389 - Remote Desktop Connection

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Amazon Cloud Instance

```
Hostname : AMAZONA-054EPQC
Instance ID : i-6907a32b
Public IP Address : 54.216.87.194
Private IP Address : 10.89.4.208
Availability Zone : eu-west-1c
Instance Size : m3.xlarge
Architecture : AMD64
```

Help, Support and Feedback

MySpine - Info
file:///C:/Users/cistib/Desktop/INFO.html

CISTIB Center for Computational Imaging & Simulation Technologies in Biomedicine

MySpine:

- XNAT: <http://myspine-xnat.cistib.org:8080/xnat/>
- Contact: support.cistib@sheffield.ac.uk
- Questionnaire: <https://docs.google.com/forms..>

GIMIAS:

- Website: <http://www.gimias.org>
- Contact: support.cistib@sheffield.ac.uk

CISTIB:

- Website: <http://www.cistib.org>
- Contact: <http://www.cistib.org/afrangi>
- Email: support.cistib@sheffield.ac.uk

MySpine VM: FEM Generation

XNAT Window Disc Segmentation Vertebra Segmentation VertAlignmentMR **CreateFEM**

54.220.75.216 - Remote Desktop Connection

GIMIAS

File Edit View Tools Selection Advanced Help

XNAT Window Disc Segmentation Vertebra Segmentation VertAlignmentMR **CreateFEM**

Working area

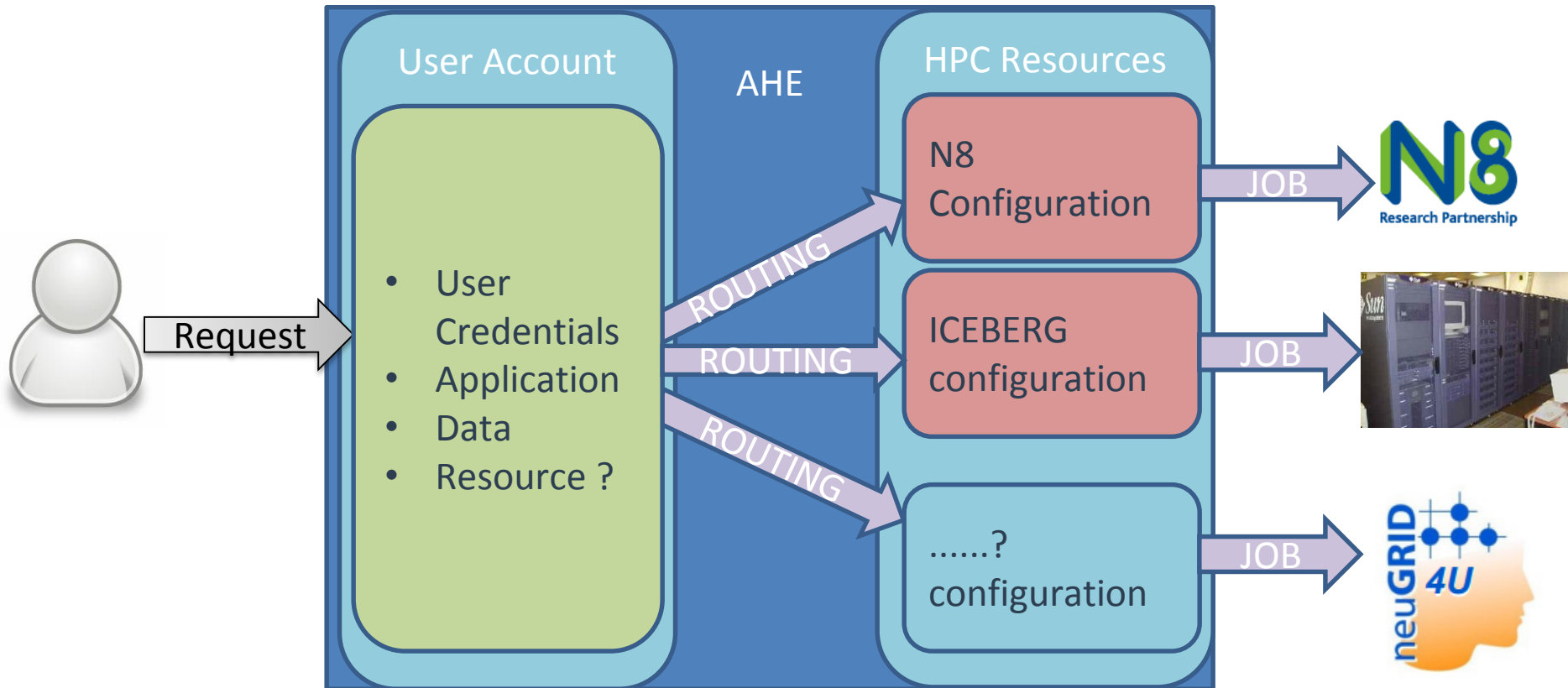
Data tree

- Root
 - XNAT Subjects
 - XNAT Query Results
 - FEM: MY0216_FEM.vtk

Patient
Specific Finite
Element
Model

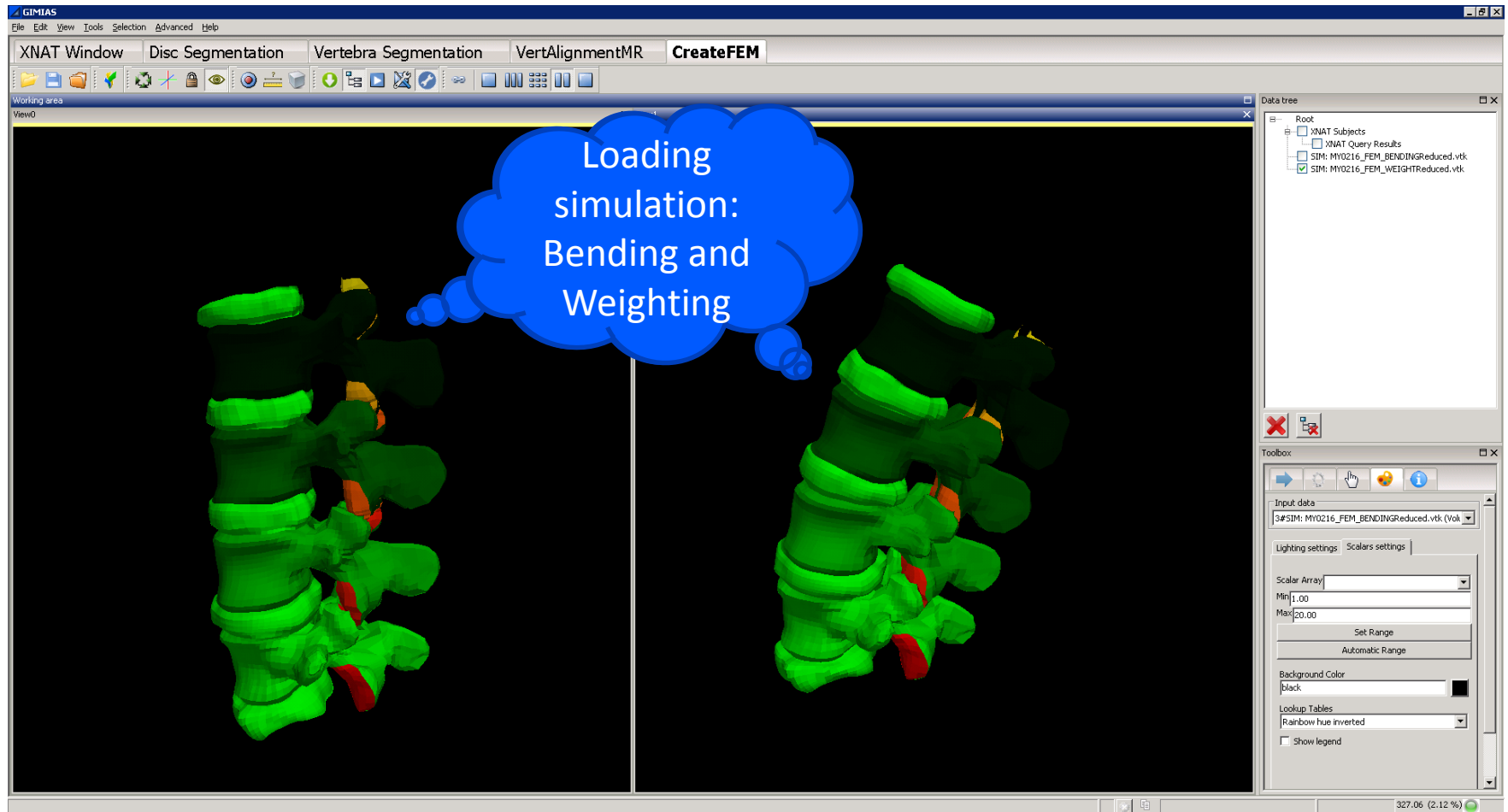
MySpine Workflow: Simulation on HPC

- Application Hosting Environment ([AHE](#))

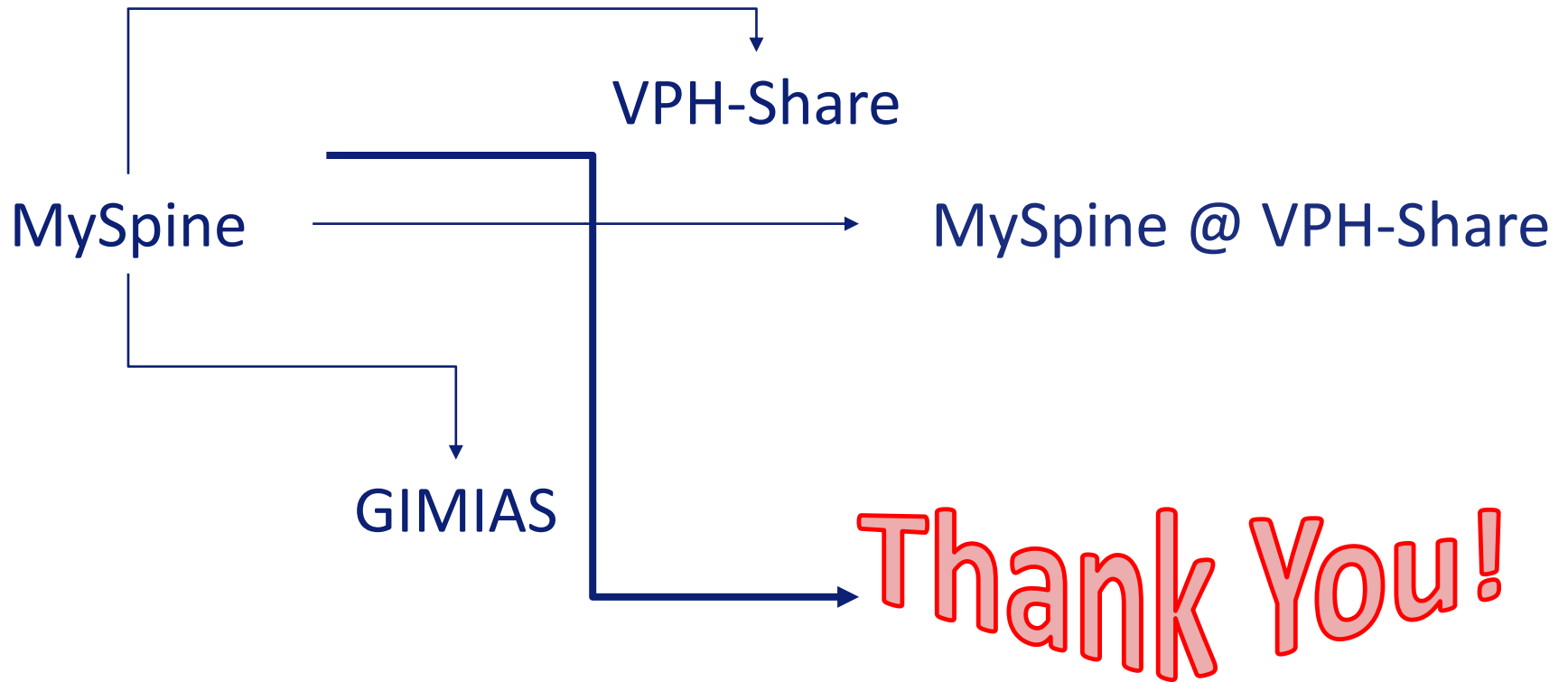


MySpine VM:

Visual Assessment of Simulation Outcomes



*** Route Information ***





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