



# JavaGAT Adaptor for UNICORE 6 Development and Evaluation in the Project AeroGrid



Tobias Schlauch, German Aerospace Center

UNICORE Summit 2009, August 25th, 2009, Delft, The Netherlands





# Outline

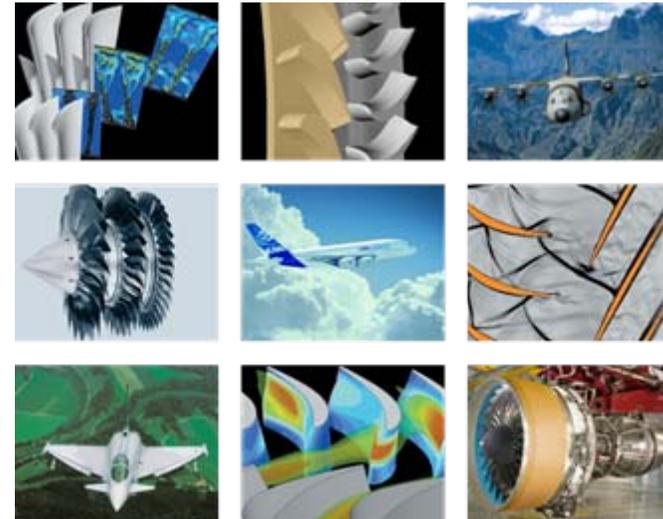
- The AeroGrid Project
- Data Management System DataFinder
- Integration of JavaGAT into DataFinder
- Summary



# AeroGrid

## Project Data

*Grid-based cooperation between industry, research centres, and universities in aerospace engineering*



**Runtime:** April 1, 2007 – March 30, 2010

**Website:** <http://www.aero-grid.de>



GEFÖRDERT VOM



Bundesministerium  
für Bildung  
und Forschung



Deutsches Zentrum  
für Luft- und Raumfahrt e.V.  
in der Helmholtz-Gemeinschaft

# AeroGrid

## Project Partner

### German Aerospace Center (DLR)

- Institute for Propulsion Technology
- Simulation and Software Technology (*Coord.*)



DLR Deutsches Zentrum  
für Luft- und Raumfahrt e.V.  
in der Helmholtz-Gemeinschaft

### MTU Aero Engines GmbH



### T-Systems Solutions for Research GmbH



T-Systems Solutions for Research GmbH

### University of the Armed Forces, Munich

- Institute for Jet Propulsion



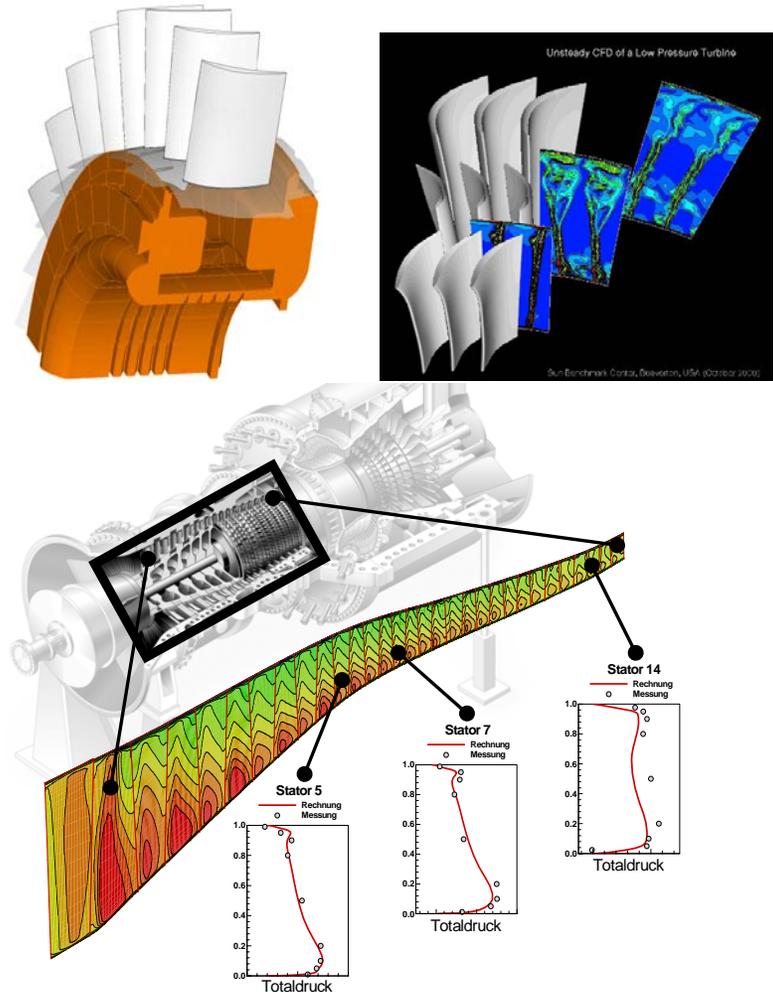
DLR Deutsches Zentrum  
für Luft- und Raumfahrt e.V.  
in der Helmholtz-Gemeinschaft

# Background: Turbo Machinery Simulation Tasks

## ➤ Simulation of turbine component

- Design (*variants*)
- Optimization
- Aero elasticity
- Aero acoustics
- Cooling
- Complex geometries
- Multistage components

## ➤ Use of the CFD-Code TRACE (Institute of Propulsion Technology)



# DataFinder

## Overview

### DataFinder

- Efficient management of scientific and technical data
- Focus on huge data sets

### Development of the DataFinder by DLR

- Available as Open Source Software

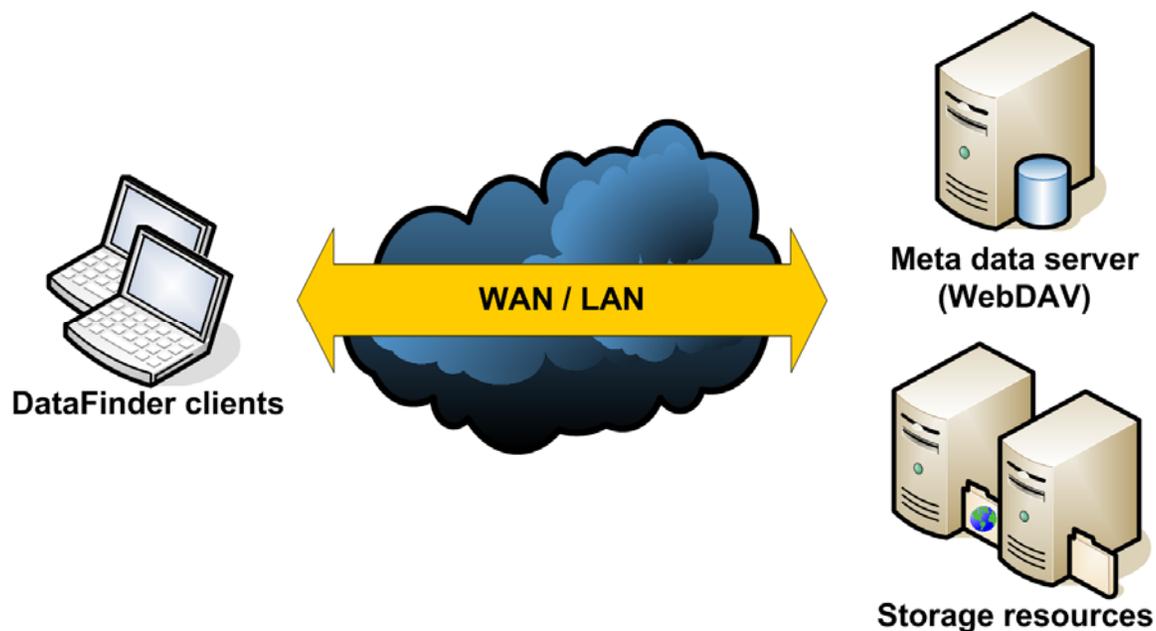
### Primary functionality

- Structuring of data through assignment of meta information and self-defined data models
- Complex search mechanism to find data
- Flexible usage of heterogeneous storage resources
- Integration in the working environment

# DataFinder

## Basic Concepts

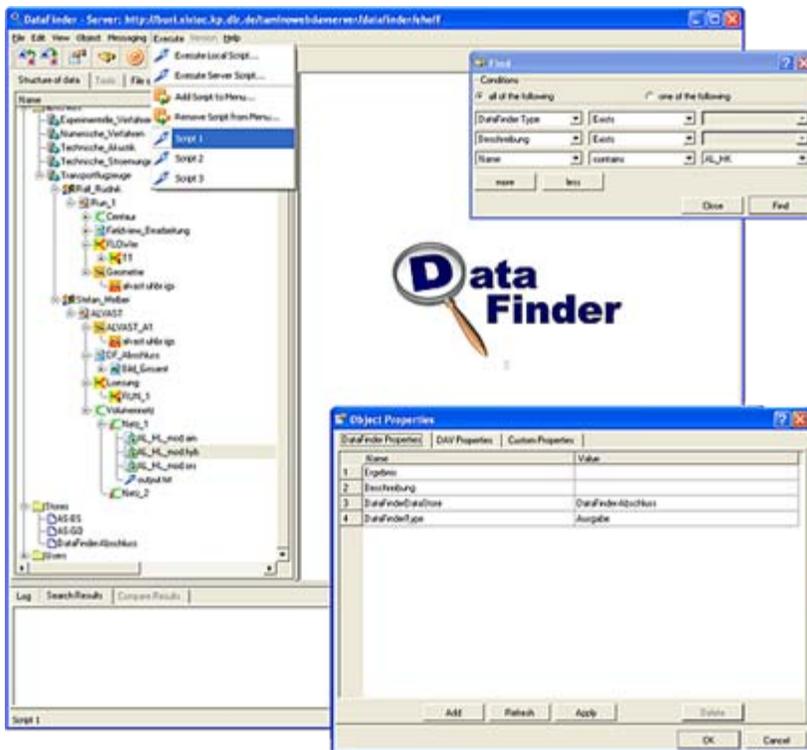
- **Client-Server solution**
- Based on **open and stable standards**, such as XML and WebDAV
- Extensive use of standard software components (open source / commercial), **limited own development** at client side



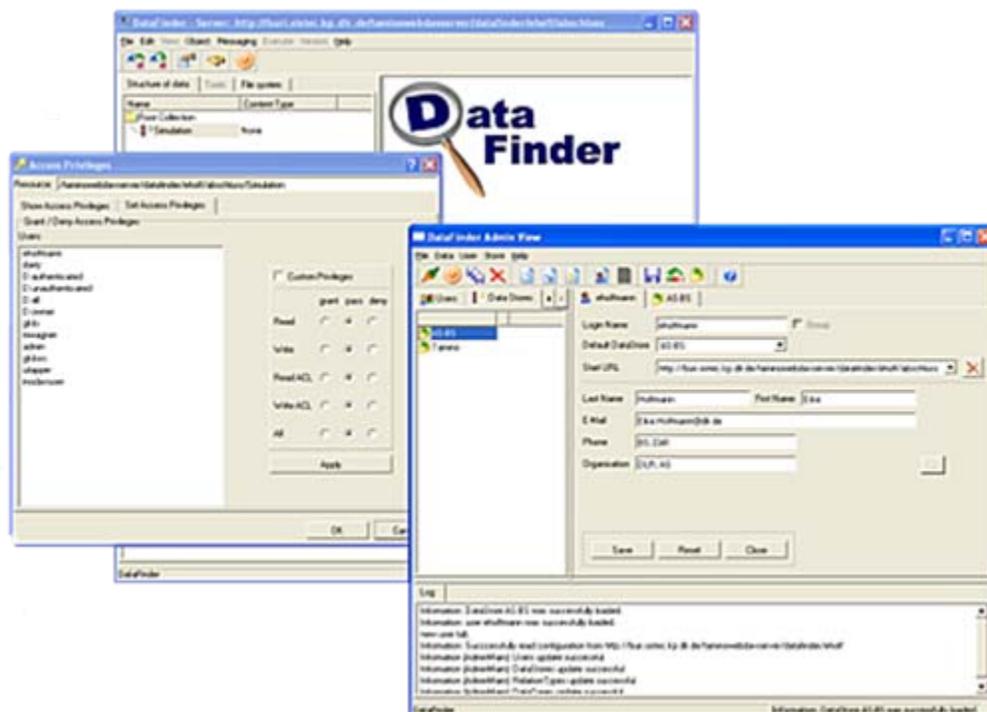
# DataFinder Client

## Graphical User Interfaces

### User Client



### Administrator Client



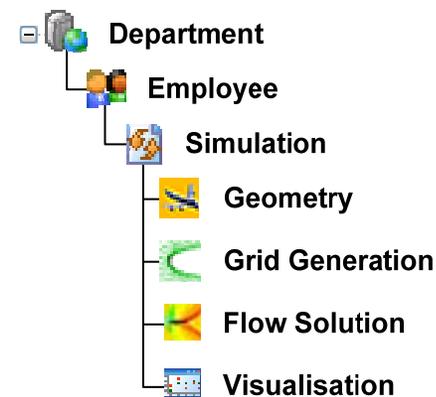
**Implementation in Python with Qt/PyQt**

# DataFinder Configuration

## Data Model and Data Stores

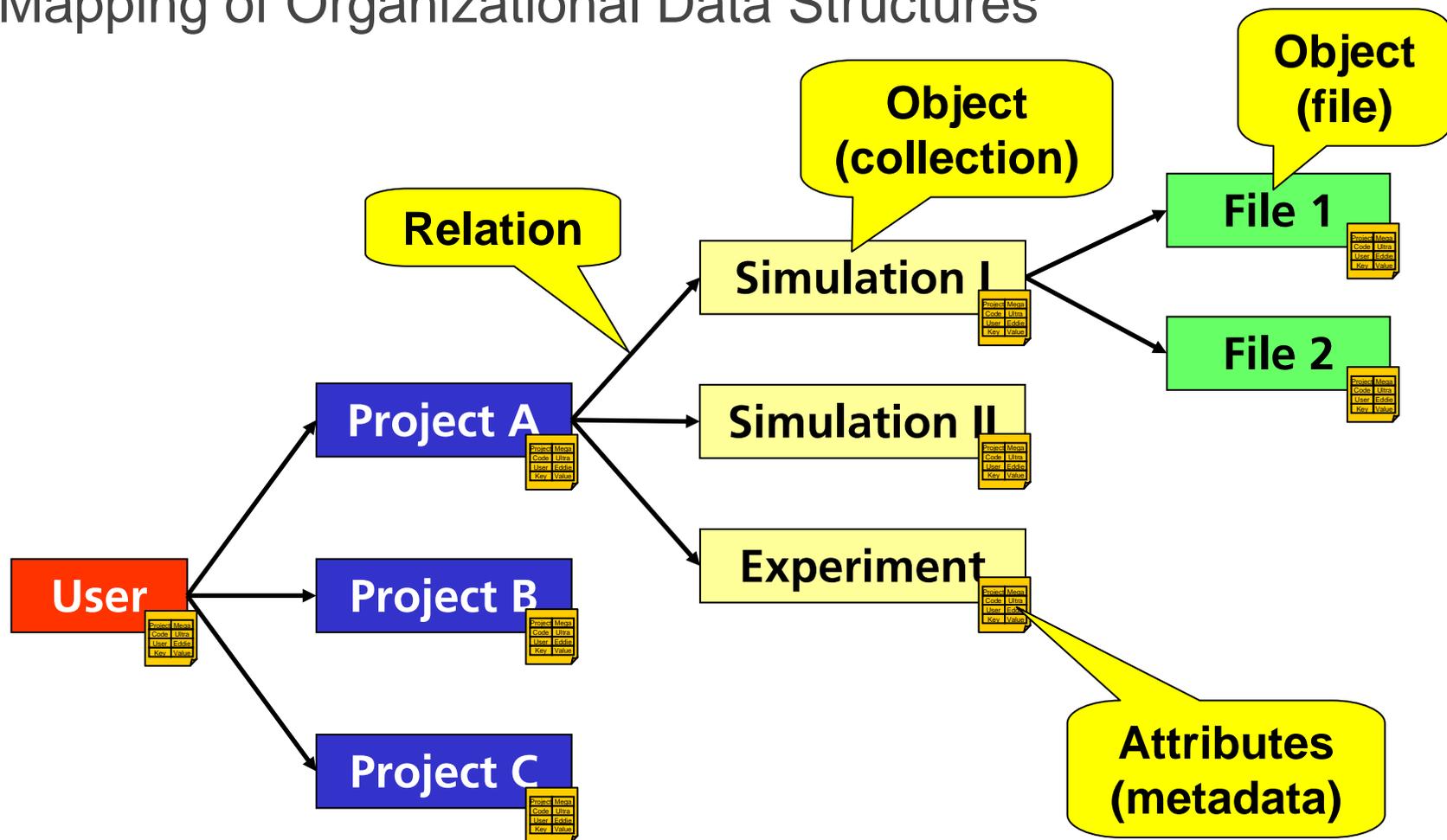
### Logical view to data

- Definition of data structuring and metadata (“data model”)
- Separated storage of data structure / metadata and actual data files
- Flexible use of (distributed) storage resources
  - File system, WebDAV, FTP, GridFTP
  - Amazon S3 (Simple Storage Service)
  - Tivoli Storage Manager (TSM)
  - Storage Resource Broker (SRB)
- Complex search mechanism to find data



# DataFinder Data Model

## Mapping of Organizational Data Structures

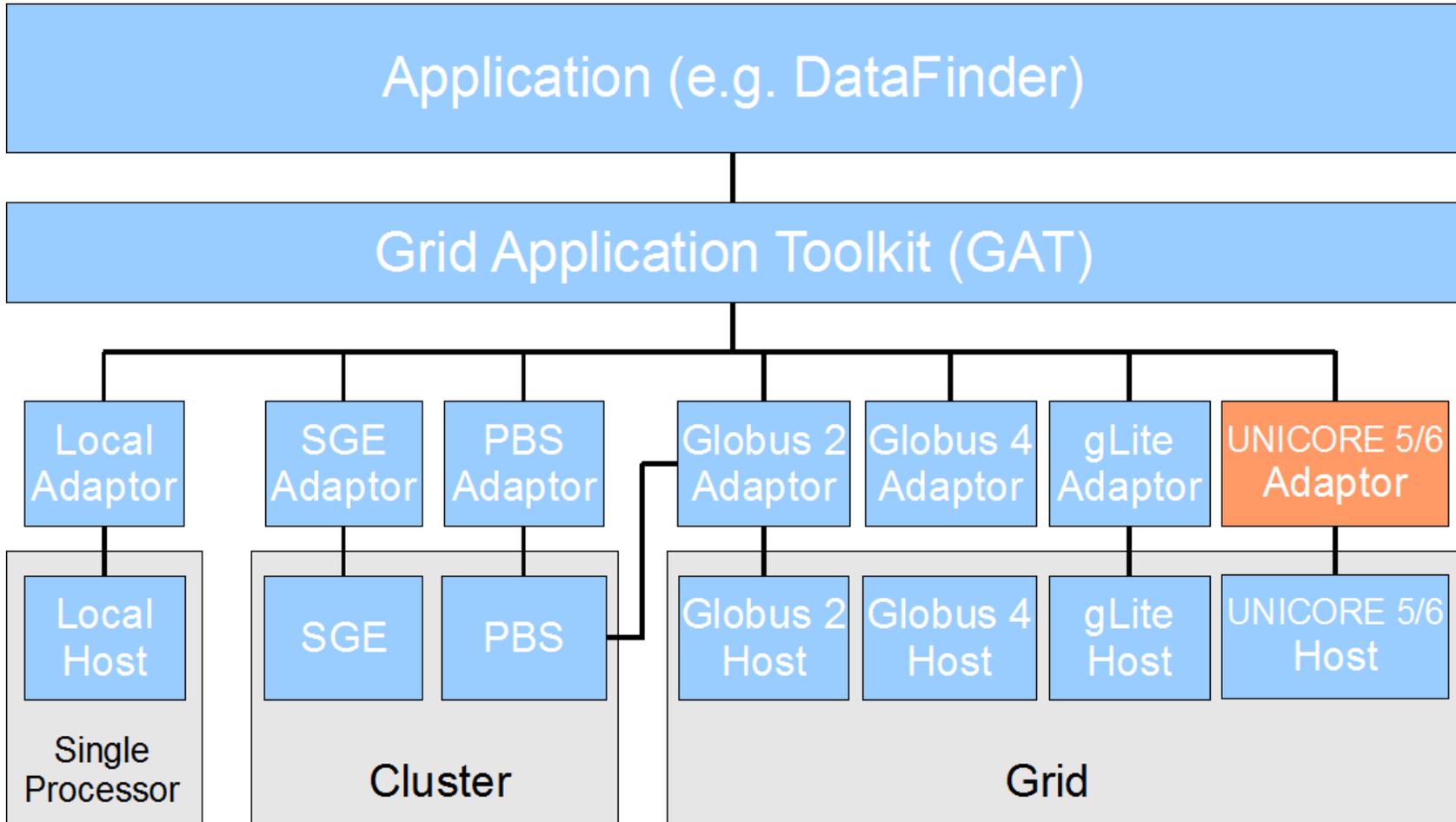


# Grid Application Toolkit (GAT)



- Provides a simple API to several grid applications
- Developed during the **Gridlab project**
  - mainly developed at Max-Planck-Institute for Gravitational Physics (Albert Einstein Institute),
  - at the Center for Computation and Technology at the Louisiana State University, and
  - at VU Amsterdam
- Implementation
  - C version
    - C++ wrapper
    - Python wrapper
  - **Java version**

# JavaGAT Architecture



# UNICORE JavaGAT Adaptor



- Developed at the Max-Planck-Institute for Gravitational Physics
- Based on **HiLA**
  - HiLA (*High-Level API*) supports the access to UNICORE 5 and UNICORE 6 via an easy and unique API.
  - It is not necessary to install components of UNICORE 5 or UNICORE 6 on the submitting (client) host.
- Implemented functionalities:
  - Pre and post staging
  - Job submission
  - Offline monitoring



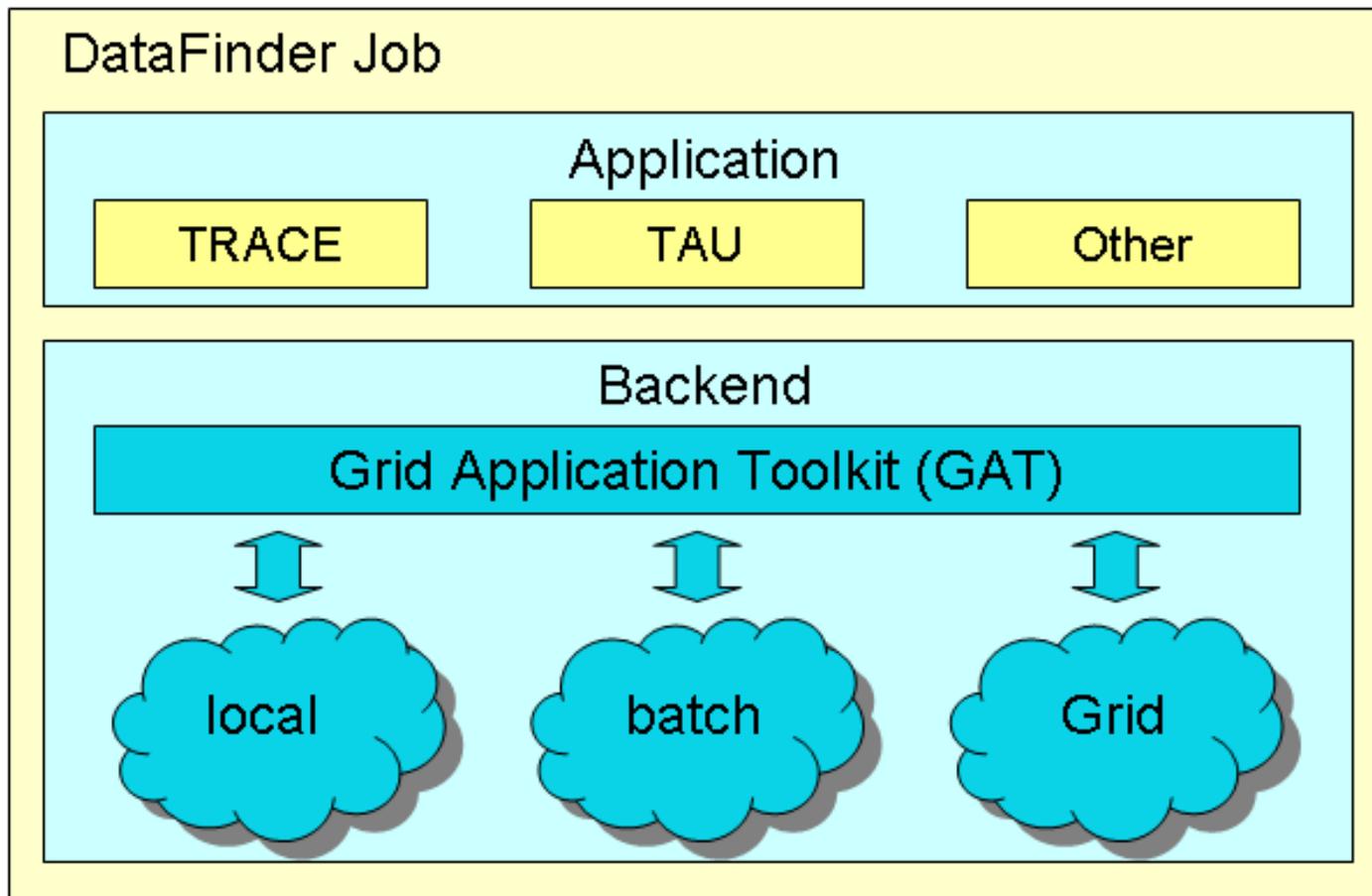
GEFÖRDERT VOM



Bundesministerium  
für Bildung  
und Forschung

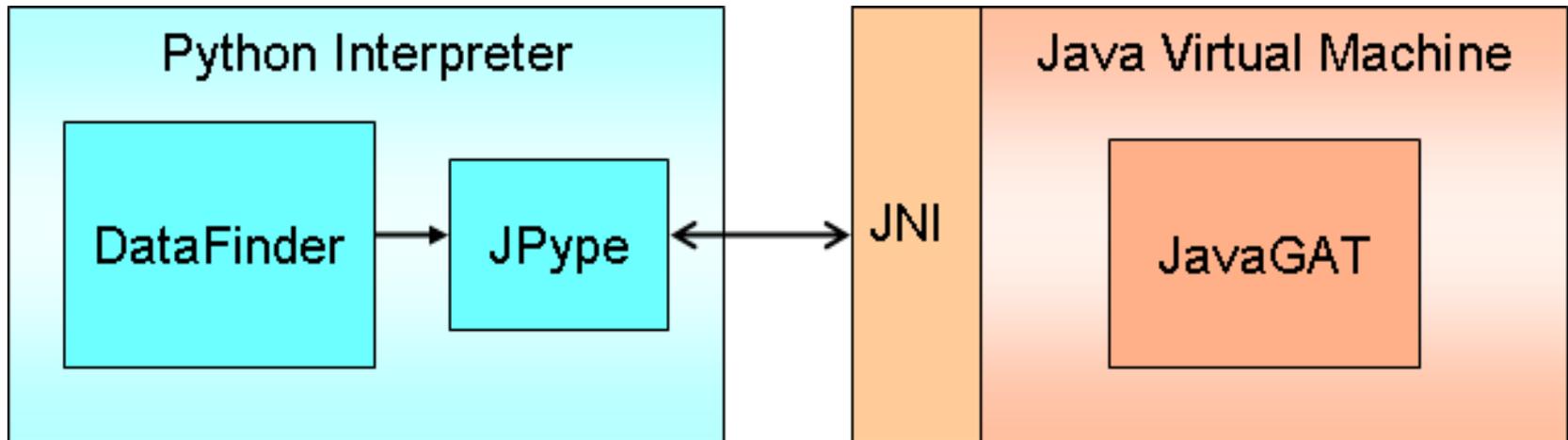


# Integration of JavaGAT into DataFinder Job Management System



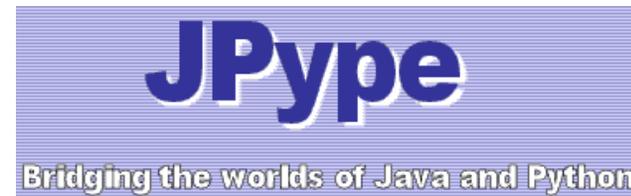
# Integration of JavaGAT into DataFinder

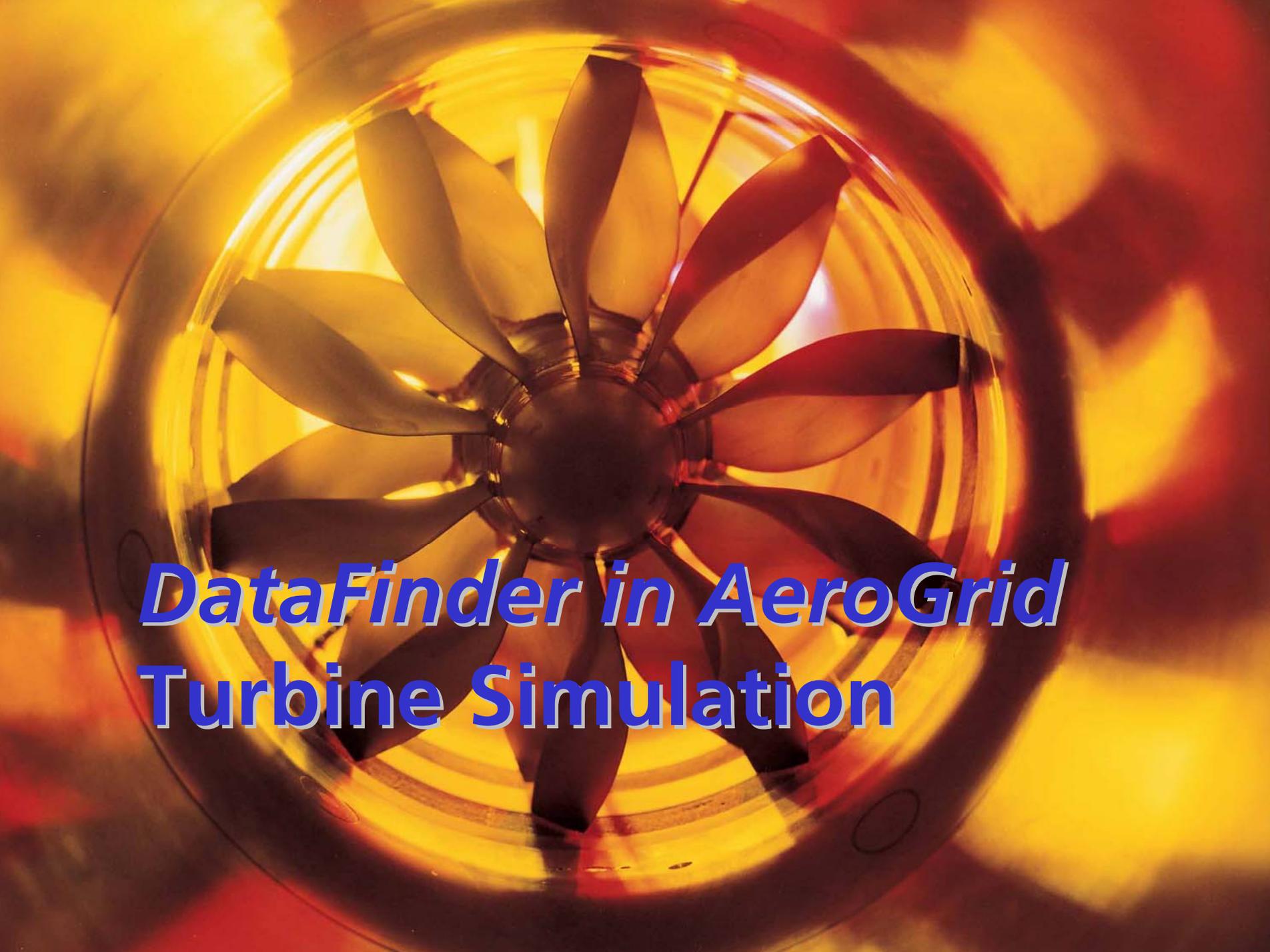
## Accessing JavaGAT libraries from Python



# Integration of JavaGAT into DataFinder JPytype

- What is JPytype?
  - JNI-based wrapper
  - Communication through interfacing at the native level in both Virtual Machines
  - Full access to java class libraries
- Project Website:
  - <http://jpytype.sourceforge.net/>





***DataFinder in AeroGrid  
Turbine Simulation***

# Turbine Simulation: Graphical User Interface

The screenshot shows the DataFinder application window. The title bar reads "DataFinder - Server: http://192.168.211.130/datafinder/data/trace/". The interface is divided into several panes:

- File System View:** Shows a tree structure of files and directories under the path `/home/jars`. The `trace` directory is expanded, showing sub-directories like `B18410`, `cgns`, `input`, `post`, and `residual`, along with various files such as `BALANCE_PROC`, `input.cgns`, `exitCode`, `TRACE_entry.input`, `TRACE_exit.input`, `trace.input`, `trace.meshquality`, `TRACE_S2.input`, `trace.solverinfo`, `myTRACE.sh`, `blk.0`, `blk.1`, `blk.2`, and `blk.3`.
- DataFinder Server View:** A table listing server resources. The `TRACE` directory is selected.
 

| Name                | DF Data Type | Content Type             | Length        | Modified       |
|---------------------|--------------|--------------------------|---------------|----------------|
| trace               | Project      | httpd/unix-directory     | (Collection)  | 12. Feb, 16:52 |
| MTU-12              | User         | httpd/unix-directory     | (Collection)  | 17. Feb, 11:37 |
| Müller              | Project      | httpd/unix-directory     | (Collection)  | 17. Feb, 11:41 |
| BC_Fourier          | Run          | httpd/unix-directory     | (Collection)  | 17. Feb, 11:51 |
| Monitoring          | Monitoring   | httpd/unix-directory     | (Collection)  | 17. Feb, 11:52 |
| SystemInfo          | SystemInfo   | httpd/unix-directory     | (Collection)  | 17. Feb, 11:52 |
| TRACE               | TRACE        | httpd/unix-directory     | (Collection)  | 17. Feb, 11:51 |
| Input               | Input        | httpd/unix-directory     | (Collection)  | 17. Feb, 11:51 |
| BALANCE_1PROC       | TRACE-Info   | application/octet-stream | 15 Byte       | 17. Feb, 11:51 |
| stcf10_1.cgns       | CGNS         | application/octet-stream | 135.289 MByte | 17. Feb, 11:51 |
| TRACE_control.input | TRACE-Info   | application/octet-stream | 3.334 KByte   | 17. Feb, 11:51 |
| TRACE_entry.input   | TRACE-Entry  | application/octet-stream | 898 Byte      | 17. Feb, 11:51 |
| TRACE_exit.input    | TRACE-Exit   | application/octet-stream | 25 Byte       | 17. Feb, 11:52 |
| TRACE_S2.input      | TRACE-S2     | application/octet-stream | 174 Byte      | 17. Feb, 11:51 |
| Output              | Output       | application/octet-stream | 174 Byte      | 17. Feb, 11:51 |
| BC_Giles1           | Run          |                          |               | 17. Feb, 11:55 |
| BC_Giles2           | Run          |                          |               | 17. Feb, 11:44 |
| BC_Riemann          | Run          |                          |               | 17. Feb, 11:58 |
- DataFinder Attributes:** A small table showing attributes for the selected resource.
 

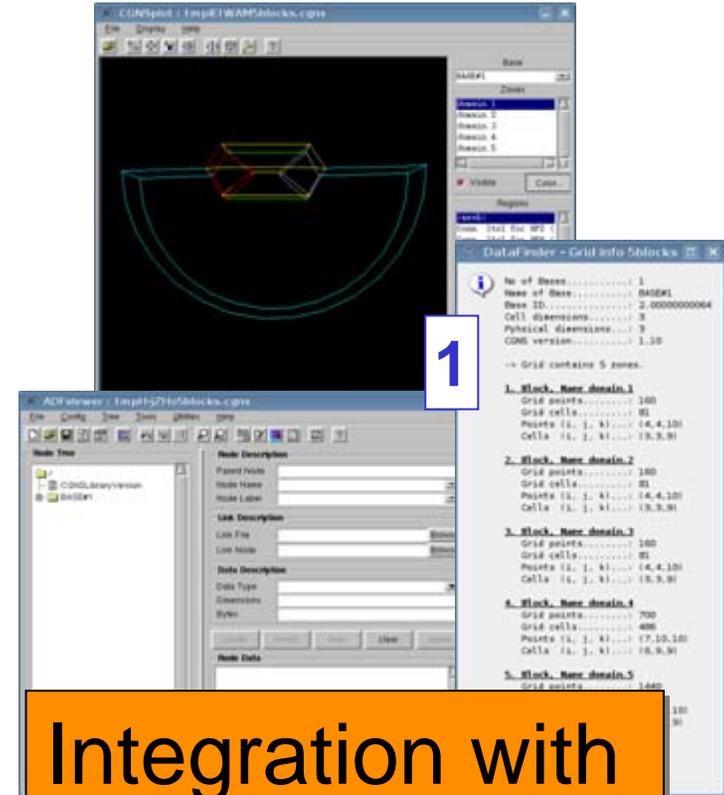
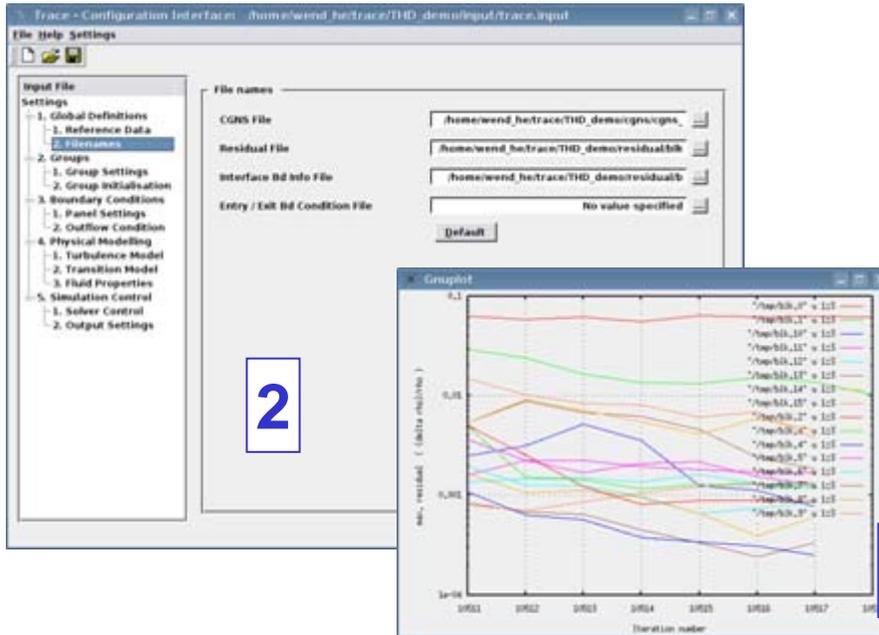
| Name | Value                |
|------|----------------------|
| 1    | CPUs 5               |
| 2    | DataFinderType TRACE |
| 3    | Version 6.3.72       |
- Start Run Dialog:** A modal dialog box for configuring the execution. It includes:
  - Resource:** A dropdown menu set to `UNICORE6`.
  - Machine to run the job:** A dropdown menu set to `aerogrid.dlr.de:443/AEROGRID`.
  - TRACE:** A section with two radio buttons: `Compile from source` (selected) and `Use existing executable`. Below the `Use existing executable` option is a text field containing `$HOME/trace_63/TRACE`.
  - Buttons:** `OK` and `Cancel`.
- Log:** A text area at the bottom showing search results for "[DataFinder Type == Run]".
 

```
11:44:45: INFO: Search results for [DataFinder Type == Run]:
• /datafinder/data/trace/Müller/Verdichter/BC_Fourier
• /datafinder/data/trace/Müller/Verdichter/BC_Riemann
• /datafinder/data/trace/Müller/Verdichter/BC_Giles1
• /datafinder/data/trace/Müller/Verdichter/BC_Giles2
4 item(s) found.
```

# Turbine Simulation

## Usage of External Applications

1. CGNS Infos / ADFview / CGNS Plot
2. TRACE GUI
3. Gnuplot



Integration with AeroGrid tools!

# Summary

- Grid Application Toolkit (GAT) is used by applications **to access grid services independently of grid middleware.**
- GAT is being **standardized within Open Grid Forum (OGF)**. Standard is called **SAGA** (Simple API for Grid Applications).
- UNICORE adaptor for JavaGAT allows access of **UNICORE 5 and UNICORE 6 resources.**
- DataFinder has been **extended to use GAT-API calls** for grid operations.



# Thank for your attention!!!

## Links

AeroGrid: <http://www.aero-grid.de/>

JavaGAT: <https://gforge.cs.vu.nl/gf/project/javagat/>

DataFinder: <http://sourceforge.net/projects/datafinder/>

## Contact

Email: [anastasia.eifer@dlr.de](mailto:anastasia.eifer@dlr.de)

[alexander.beck-ratzka@aei.mpg.de](mailto:alexander.beck-ratzka@aei.mpg.de)

