



FH Bielefeld
University of
Applied Sciences



Visu@IGrid - Realization of a development environment for model-based design and code generation of heterogeneous client server applications

CHRISTIAN BENJAMIN RIES
COMPUTATIONAL MATERIALS SCIENCE & ENGINEERING
UNIVERSITY OF APPLIED SCIENCES
BIELEFELD, GERMANY

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- **Visu@Grid uses BOINC**

(BERKELEY OPEN INFRASTRUCTURE FOR NETWORK COMPUTING)

- BOINC IS A PUBLIC RESOURCE COMPUTING INFRASTRUCTURE...
- ...CAN ALSO BE USED IN COMPANIES OR IN PRIVATE NETWORKS.

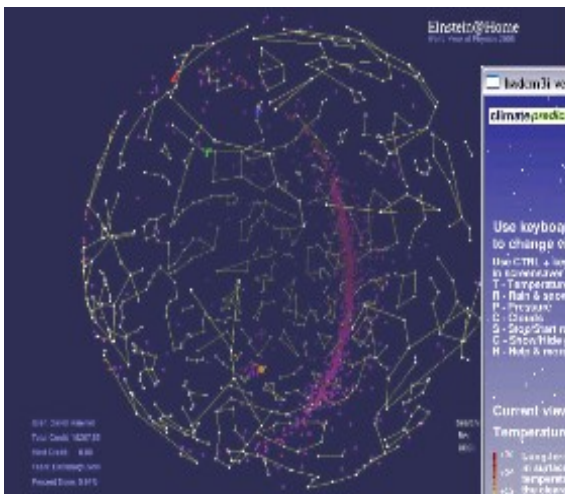
Public Resource Computing (PRC) != Grid Computing (GC)

PRC:

- ... participants share their processor and computer resources
- ... asymmetric relationship between projects and participants
- ... projects are typically small academic research groups with limited computer expertise
- ... participants are individuals with different operating systems

GC:

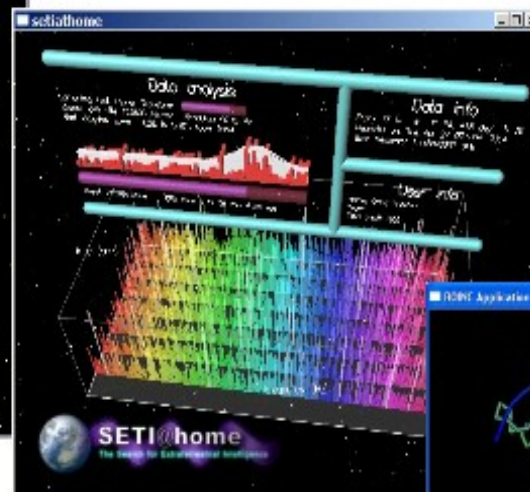
- ... involves organizationally-owned resources: supercomputers, clusters, and PC's owned by universities, research labs, and companies
- ... resources are centrally managed by IT professionals and are powered most of the time



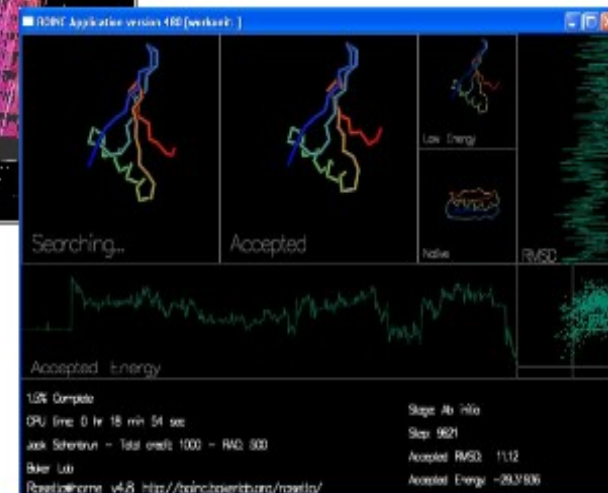
Einstein@home



Climateprediction.net



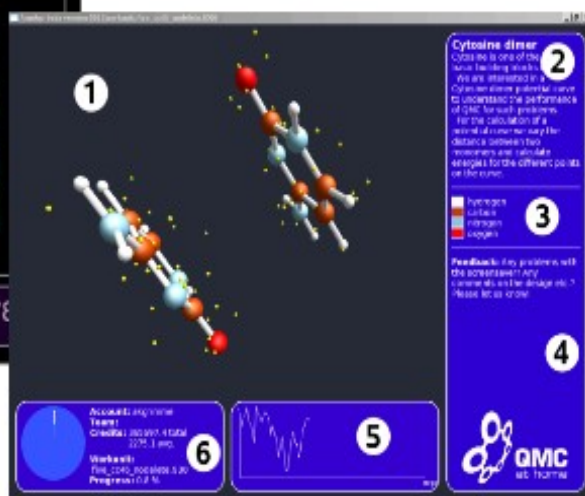
SETI@home



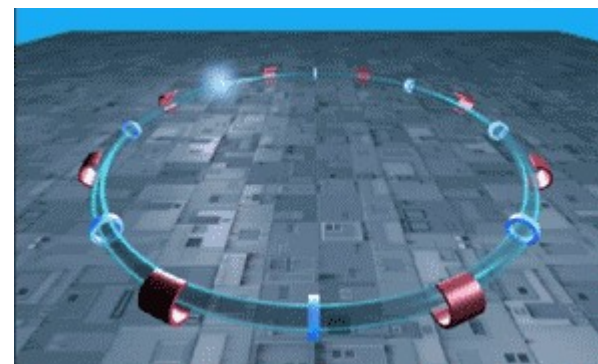
Rosetta@home



Spinhenge@home

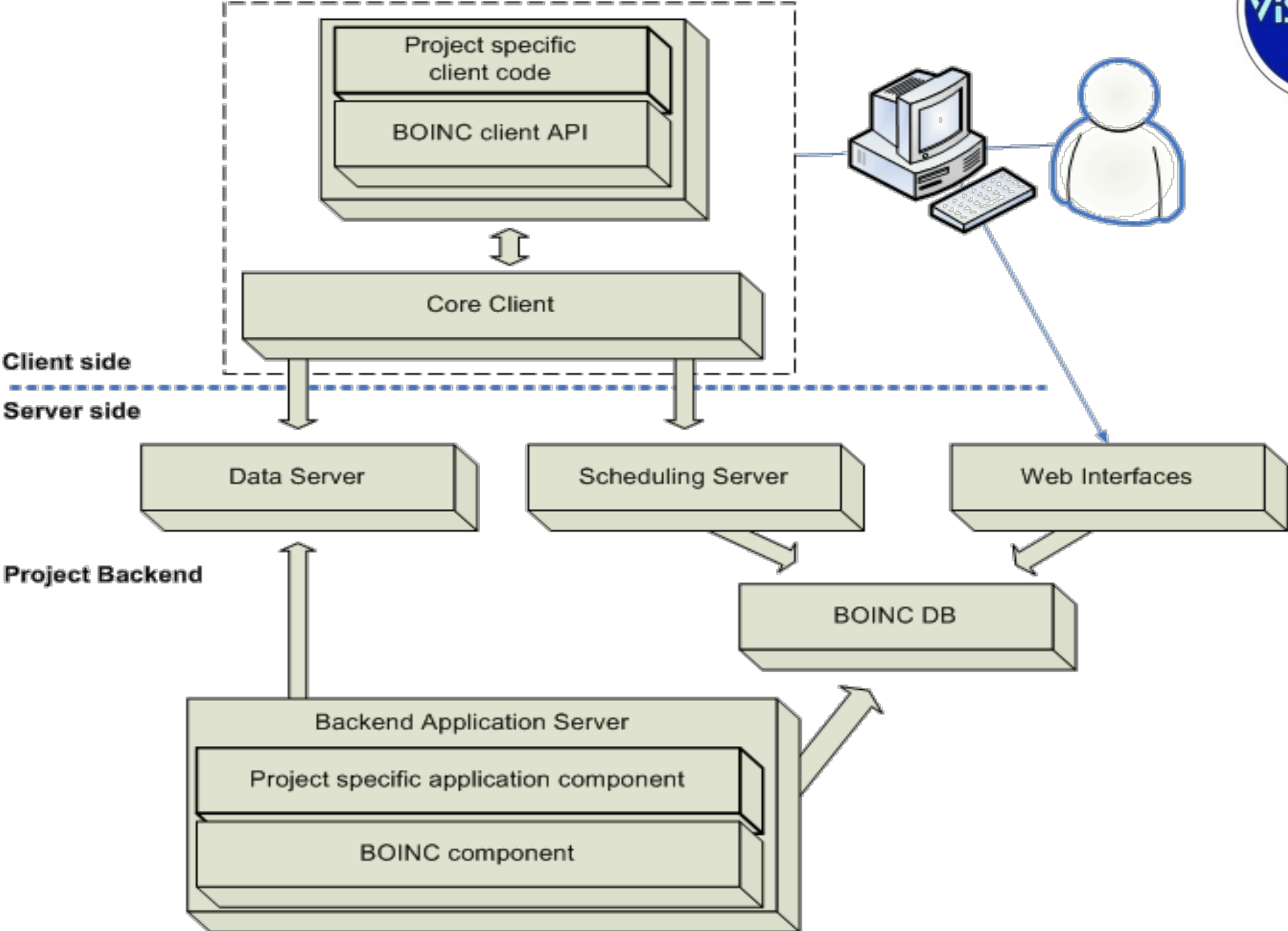


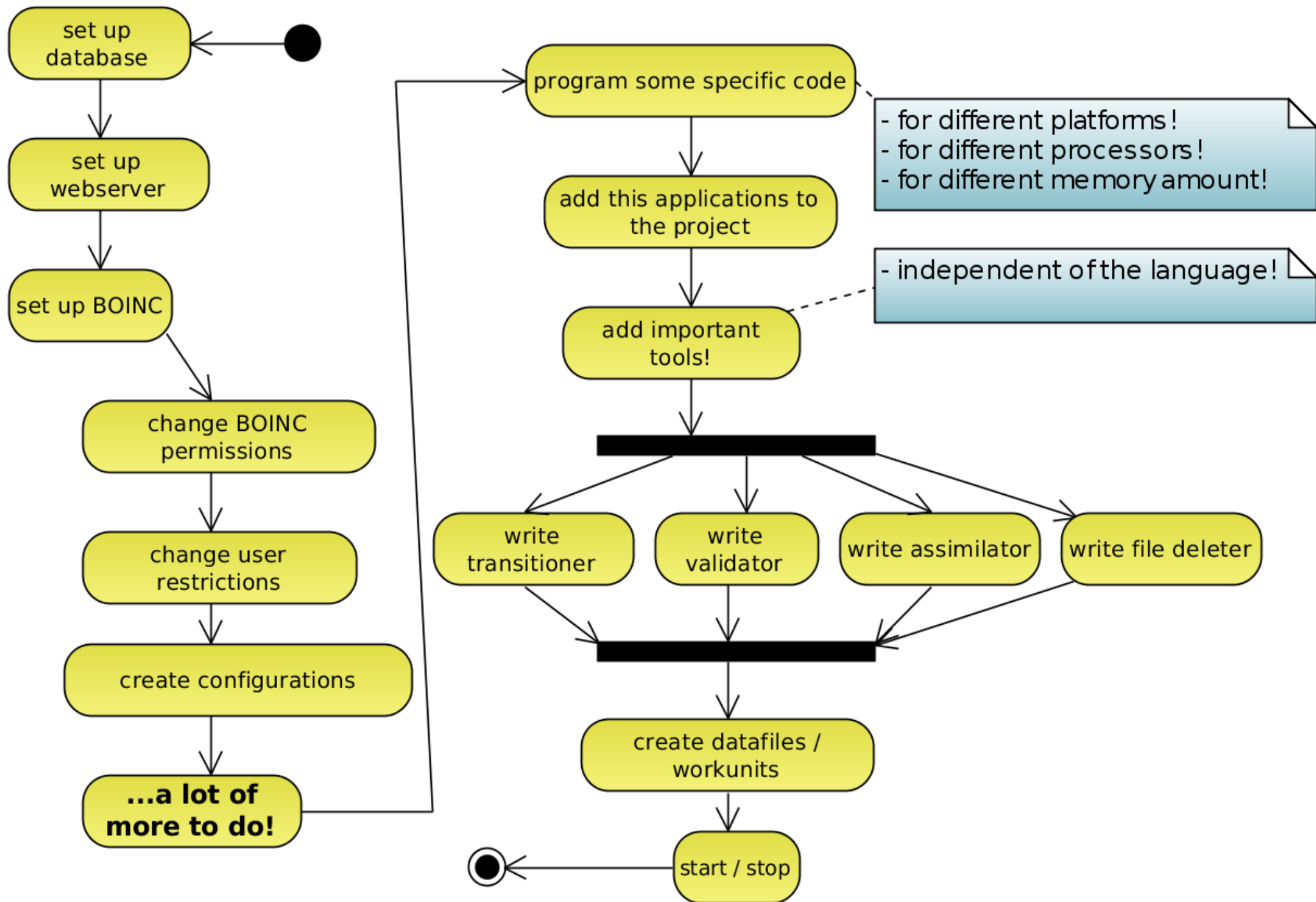
QMC@home

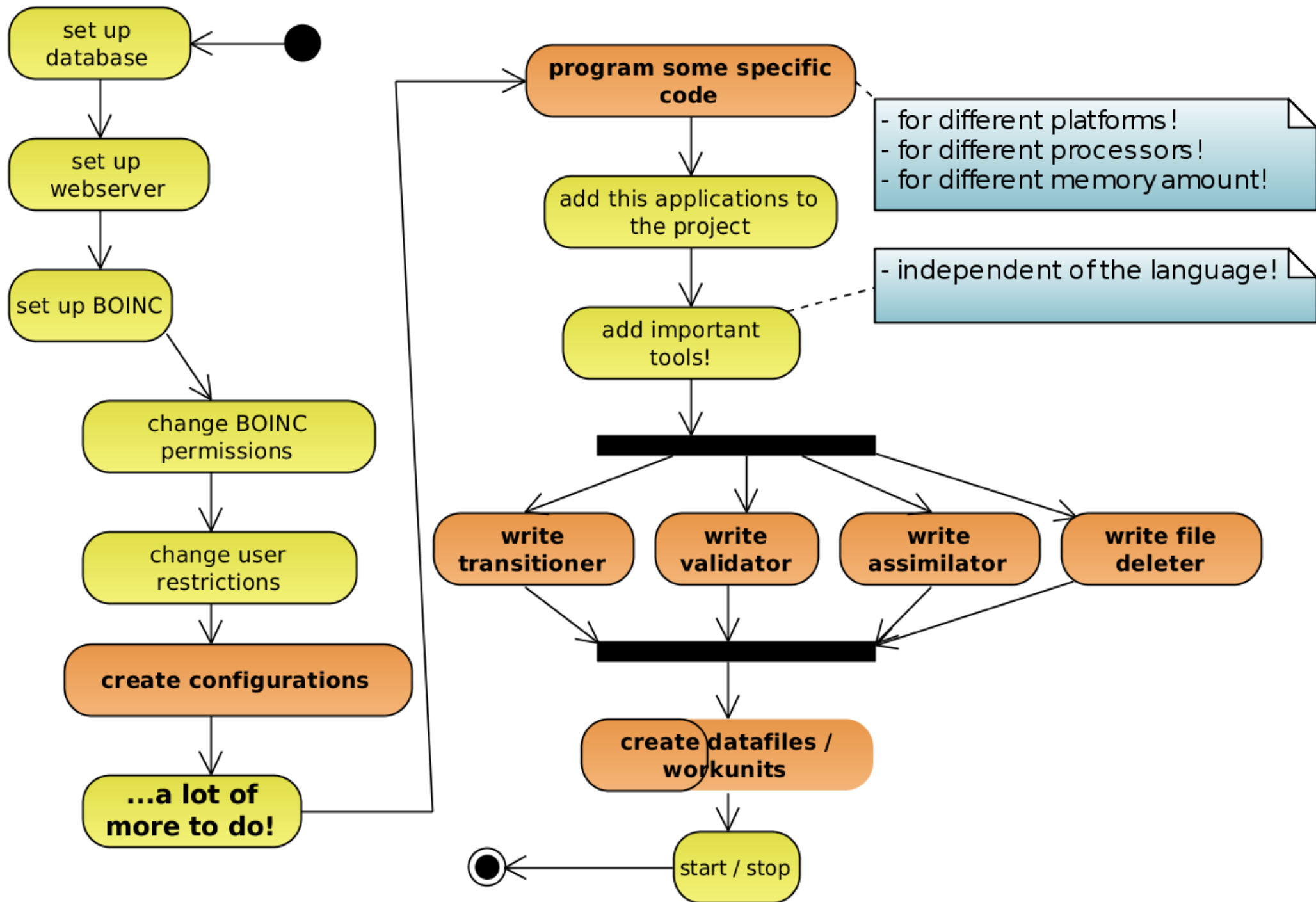


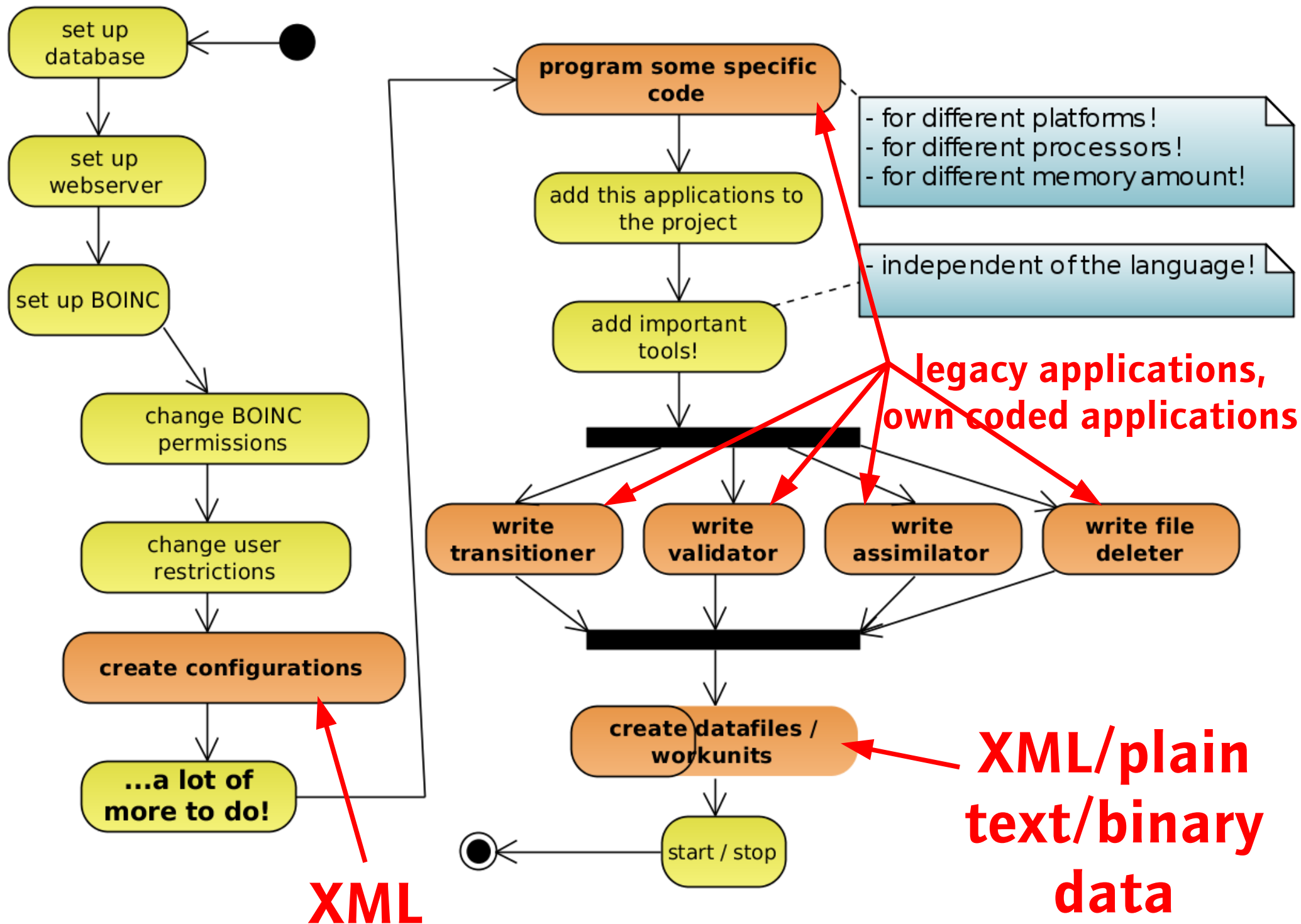
CERN's LHC@HOME

BOINC Architecture











- **Central Processor Units (CPU)**
 - **Single core**
 - **Multi-Core** , SUPPORTED BY E.Q. OPENMP, MPI

- **Graphics Processing unit (GPU)**
 - **Open Computing Language (OpenCL)**

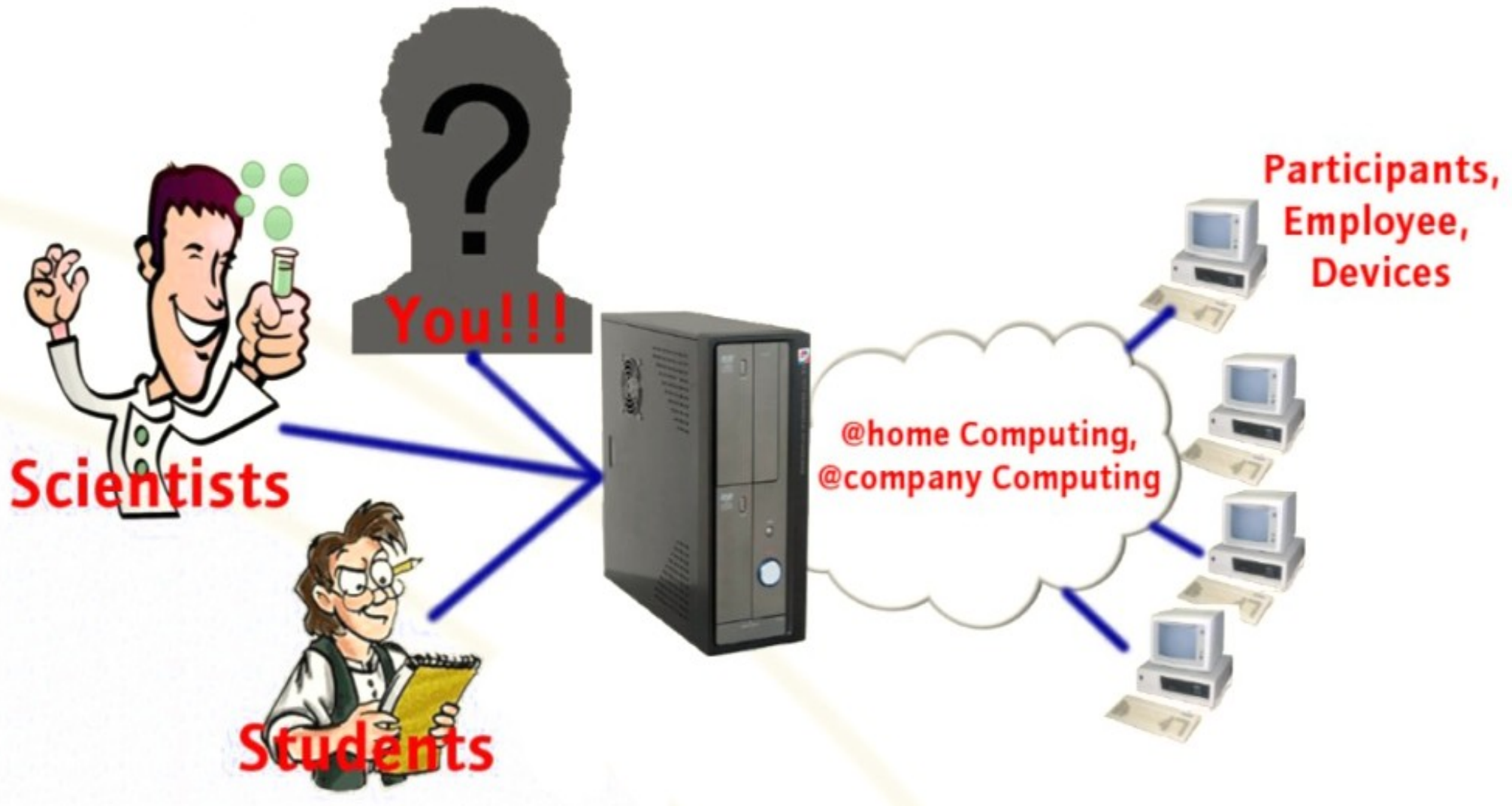


- **Windows, e.g. 32/64 Bit**
- **Linux, e.g. x86, SMP**
- **Mac OS/X**

- **...Fieldprogrammable gate arrays (FPGA)?**
- **...Playstation 3?**
- **...home devices?**

The Challenge...

... make it as easy as possible!



The Challenge...



... make it as easy as possible!

The main goal of this project is the realization of a software development environment called „Visu@Grid“ which allows one to develop applications based on the „Berkeley Open Infrastructure for Network Computing (BOINC)“ by graphical and textual modeling and complete code generation!

**Visu@IGrid –
Development-Environment for
modelling of graphical
heterogeneous Client-Server-
Application with automated
Code-Generation**

Modelling Language

Visu@IGridML

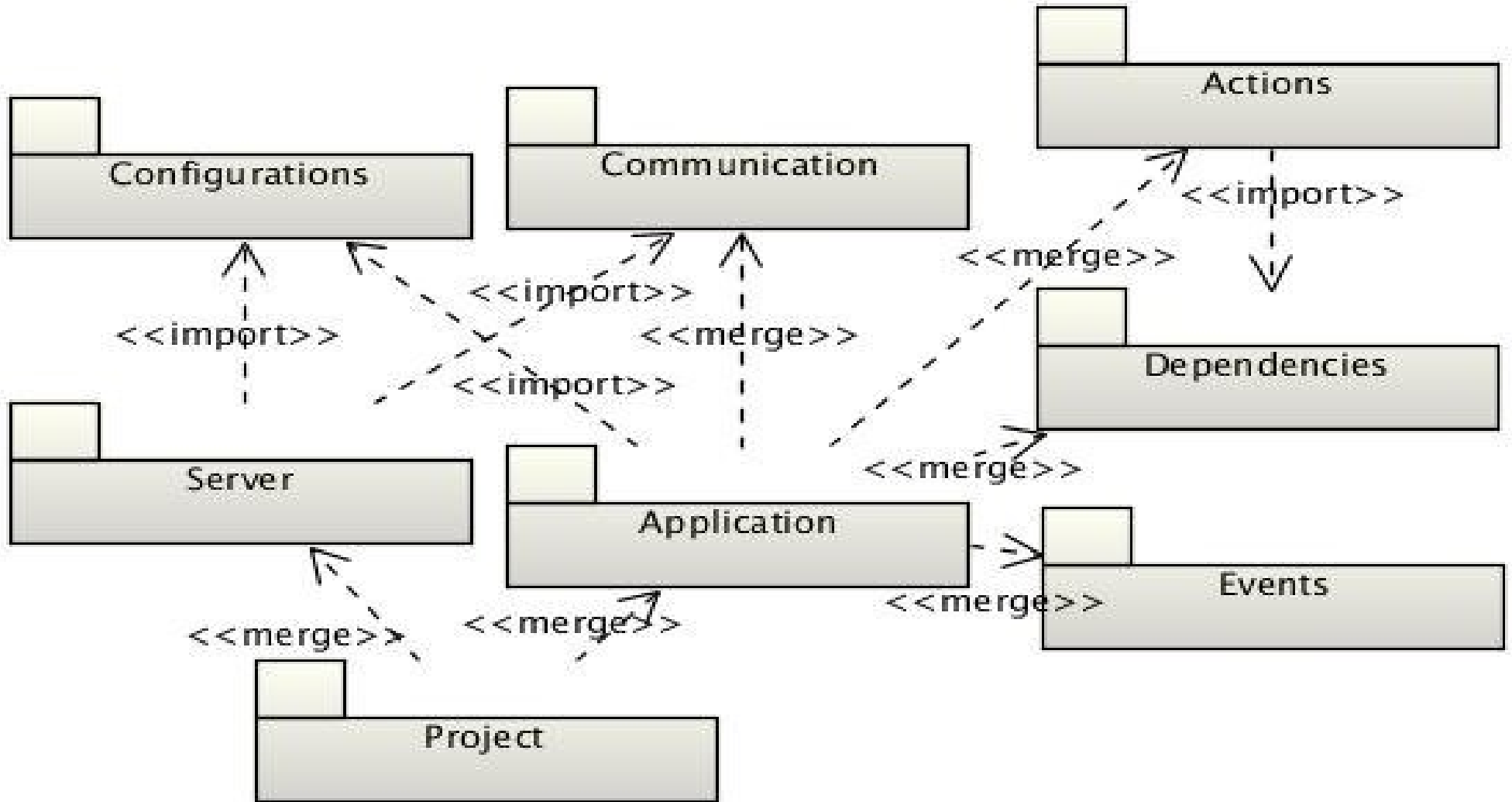
**Diagrameditors
User Interface**

Visu@IGridIDE

Code-Generator

Visu@IGridCG

**Standardservices and Standardprotocols, standardized, open and
general usable Interfaces (BOINC, Eclipse, UML, XML, etc.)**



Domain Specific Language



```
inc BoincIncludes {
  "~/boincadm/src"
  "~/boincadm/src/api"
  "~/boincadm/src/lib"
}
lib BoincLibraries {
  "~/boincadm/src/api", "boinc_api"
  "~/boincadm/src/lib", "boinc"
  "/lib", "pthread"
  "/usr/lib", "jpeg"
}
mode single;
processor cpu;
on heapcheck | memoryleakcheck;
```

In order to create applications with multicore or GPU computing support the following statement can be used:

```
mode multi;
processor gpu;
opencl yes;
```




CALCULATION, SIMULATION DATASETS AND RESULTS:

```
infile "metropolis_data.xml"  
    as ObjectName1;  
infile "param.jj" as ObjectName2;  
infile "param.nn" as ObjectName3;  
infile "param.ww" as ObjectName4;
```

After the execution of the client application the results are stored in *result files* defined by the statement `outfile` and are uploaded to the server.

```
outfile "metropolis_out.erg"  
    as ObjectResult1;
```



CALL CALCULATION OR SIMULATION ROUTINES:

```
worker Spinhenge {  
  use "do_work()";  
}
```

This statement could be replaced by other instructions, e.g.

```
worker Spinhenge {  
  cpp {  
    int a = 42;  
  }  
  action(modeledFunction(a));  
}
```



LEGACY APPLICATIONS, WRAPPER ROUTINES:

```
worker Spinhenge {  
  wrapper {  
    env("Matlab", "Argv[1] Argv[2]" [,  
      weight, checkpoint_filename,  
      fraction_done_filename, ...])  
  }  
}
```

THANKS FOR YOUR ATTENTION!



References:

DAVID P. ANDERSON, „BOINC: A SYSTEM FOR PUBLIC-RESOURCE COMPUTING AND STORAGE“, SPACE SCIENCES LABORATORY (2004)

C. B. RIES, T. HILBIG, C. SCHRÖDER, „ENTWURF: UML 2.2 PROFILE: VISU@LGRIDML“, UNIVERSITY OF APPLIED SCIENCES BIELEFELD, GERMANY (2010)

C. B. RIES, T. HILBIG, C. SCHRÖDER, „VISU@LGRID -REALIZATION OF A DEVELOPMENT ENVIRONMENT FOR MODEL-BASED DESIGN AND CODE HETEROGENEOUS CLIENT SERVER APPLICATIONS“, SUBMITTED TO THE INTERNATIONAL SUPERCOMPUTING CONFERENCE (ISC), HAMBURG (2010)

Learn more about



and become part of it!

<http://spin.fh-bielefeld.de>