

Sustainability

Brussels

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Training Materials

- Wide range of training material developed
 - Best practices and Tools for Scientific Programming
 - Parallel/High Performance I/O
 - Basic software optimisation techniques
 - HPC Infrastructure
 - Introduction to New/Novel HPC Hardware (FPGAs, GPGPUs, and Cell Processors)
 - Data Intensive Computing
 - Using the EUFORIA Grid
 - Using the EUFORIA Grid for Parallel Programs
 - Parallel Fast Fourier Transforms
 - Genetic Algorithms for Fusion and the Grid
 - GPGPU Programming
 - Message Passing Programming: MPI
 - Shared Memory Programming: OpenMP
 - Autobuild and make tools
 - Revision control using SVN and the ITM Gforge system
- Material available online
 - EUFORIA web and indico site
 - Available beyond end of project

Enabling users - enabling science!

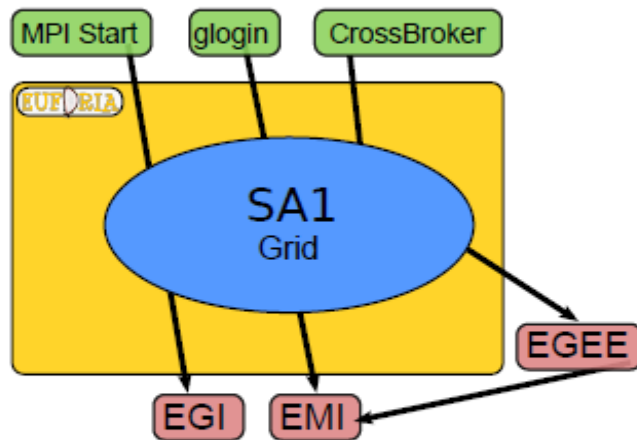
- Material re-used by others
 - Courses and training in local training programs and workshops/courses
- Training material has a limited lifetime
 - Core training provided by infrastructure projects
 - GOTiT and HLST take forward training challenge for fusion community

Website – contacts and distribution

- Material developed with the lifetime of EUFORIA will be valuable **beyond the end of the project** (mainly companion guides, promotional material or software developments).
- The web will act as **repository** during the two years after the end of the project.
- Besides, **updates** of relevant information (i.e. deliverables) will be performed during this period.

Continued sustainability of grid access/tools

- Interactive Grid Tools (inherited from Int.EU.Grid)
 - MPI-Start: A universal way to start MPI programs on the grid
 - G-Login: Enabling interactivity on the grid
 - CrossBroker: Advanced interactivity and priority on the grid
- ⇒ Tools established in the EGI context, available, e.g. in Fusion VO



- Impact on Fusion researchers:
 - The required tools (as defined in Euforia) are now available on Grid infrastructure (Fusion-VO)
 - Interactive, parallel Jobs are now available to users
 - Cloud prototype is accessible and will be pursued to add features and resources
- ⇒ 22 Publications written, using the grid

HPC Infrastructure - Sustainability

- HPC-FF
 - Large scale HPC resource for Fusion
- National and European Facilities
 - Help users with DEISA and PRACE applications
- Medium scale resources much more common
 - Local and national centres commonly have large (couple of thousand cores) resource available
 - This is a change over the course of the project

SA3 - Impact and Sustainability

- SAFE Software Evaluated through user questionnaires
 - SA1 and SA2 evaluations
- Software developments
 - Integrated back into main development
 - Used for other projects and places (UK national service, DEISA accounting, etc...)
- Support provision
 - Service available at least 6 months beyond project end
 - Move active and re-current queries to infrastructures (i.e. DEISA, PRACE, EGI)

JRA1

Sustainability

- **Grid team** willing to give **support** to fusion users under scientific collaboration basis.
- **Fusion VO** keeps as production infrastructure.
- **Expertise** on using **Kepler** as workflow engine and **VisIt** as graphic tool.

Sustainability Path - HPC codes and knowledge

- Results have been communicated to code developers personally: transfer of knowledge
- Clear benefits from improvements on any existing CPU-based HPC system
- Workflows have been shown to be feasible
- Cooperation with High Level Support Team at Garching/EFDA, Max Planck Institute providing them with all our internal reports to help them with their work eg on parallel file I/O.

Sustainability Path

- *Continuous developments* in hardware (eg GPGPU) and software (file I/O, MPI) require *continuous efforts* in programming and even program redesign to benefit from those new resources.

Promoting Workflow technologies and related tools

- **Developments committed back to Open Source repositories (KEPLER)**
 - RAS actors (GRID, HPC & Cloud) => available for other communities and users
- **Developments shared with the Fusion community (ITM-TF):**
 - Revision control using SVN and the ITM Gforge system
 - UAL developments are included in the standard ITM version
 - HPC2K updates have been committed to ITM
 - Demonstrations and examples with Fusion codes are now moving to production run
 - Several JRA3 partners are now working within ITM-TF

Trained community and continuous support

- **Training & dissemination**

- ITM general meetings: Portici (2008), Karlsruhe (2009)
- Supercomputing Conferences: SC09 (Portland), SC10 (New Orleans)
- EGEE meetings: Uppsala
- GridKa 2009 school
- ITM & PSNC web sites
- Public videos: YouTube

- **Further deployment of the tools developed**

- EGI_Inspire: Fusion, interest from Quantum Chemistry community (under evaluation)
- PSNC will continue to support new middleware releases (gLite, UNICORE ...)
- ITM-TF is developing a parallel UAL version for HPC-FF

Visualization tools

- External open source software
 - Python and VisIt supported by their community
- UAL interfaces and Kepler actors
 - Maintained by ITM for fusion community: small costs thanks to XML automatic generation! 😊
 - Generic version of actors could be taken by Kepler community
- Compression tools and 4D visualization
 - Open source (CECILL-B license)
 - Maintained by UDS

EUFORIA



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