eScience: Insight out!

Enabling digitally enhanced research through efficient utilization of data, software and e-infrastructures

Two-pager to the *White Paper on the potential of eScience*

By

PLAN-E

The Platform of National eScience Centers in Europe

Pre-amble

eScience: Insight out!, issued as a White Paper by PLAN-E, the Platform of National eScience Centers in Europe, discusses two topics: the concepts of eScience, the modern way of doing research, and PLAN-E, which is set up to support the promotion and proliferation of eScience in Europe and beyond. The principal idea behind the White Paper is to enlighten all about the progress in science that can be made when the most modern ICT, technologies and tooling are used as well as the existing e-infrastructures as a whole (rather than isolated components).

Introduction

The natural evolution of science has recently taken on a *new direction*, enabled by the intrinsic absorption into the science process itself of the myriad of tools that ICT, e-Infrastructures and cross boundary/disciplinary co-operation have presented us with so far and will bring us in the future. This new direction, with its holistic view of e-infrastructures, computational methodologies & data science tooling, as well as its cooperative and open nature, results in *enhanced* research capabilities and as such links in well to the European Open Science Cloud endeavours.

The eScience Perspective

The eScience perspective is a hawk eye's view on the state-of-the-art of:

- The complete reservoir of e-infrastructural tools and services as well as ICT products in any time;
- The algorithmic methodologies in Computational Science;
- Data Science analytics and other developments,

so it can provide a holistic perspective to scientists in all domains to accelerate the discoveries in their field.

What is eScience about?

eScience is a self-developing community of principles and practice, as well as a new concept and a new paradigm concerned with enhancing science through the optimal deployment of ICT tooling, software and e-infrastructures in scientific research challenges. This allows scientists to conceive their present and future research challenges without direct translation of the issues at hand into solution directions known to *them*. Rather the eScientists of today help shaping the research question as to deploy the most modern techniques and using the best of e-infrastructures available at any time. eScientists may even reset their challenge level to higher standards because of the potential of ICT or the use of the e-infrastructure as a whole, rather than using just elements thereof.

Among the many elements that are involved in this new domain are:

- Problem driven, multi-dimensional approach;
  - The science and societal challenges lead;
  - Complex research questions addressed by larger, European of Global teams;
- Value adding:
  - Take care of re-usability of tools, software and data;
  - Take Data Stewardship and Software Sustainability seriously;
  - Use what is already available, create where required;
- Openness and Sharing:
  - Open Science, where possible, Closed where needed;
  - FAIR principles whenever possible;
  - Early knowledge exchange;
  - Crossing over of knowledge and experiences across disciplinary boundaries;
  - Stimulate innovation by pushing public research results into the industry;
  - Enhancing economic competitiveness, for example through spin-offs;
  - Help bridging the digital divide;
- Computational Science methodologies, Data driven approaches and visualization are embedded.

eScience: Insight out!

eScience: Insight out! Contains the following topics:

- A description of eScience;
- Backgrounds, history, embedding and challenges;
- Contributions to the development of science and research;
- Requirements regarding e-infrastructures;
- eSkills;
- Software Sustainability and Data Stewardship (RDM)
- Communities;
- The states-of-the art;
- Potential to inform governments, policy organizations and the scientific community.

The paper *concentrates* on eScience as a new working domain and incidentally refers to the role of PLAN-E.

PLAN-E is a new European vehicle to get the eScience message across, promote and support its development and concentrates on a limited set of concrete actions.

Requirements

Requirements for the successful emergence of this fourth paradigm direction are:

- early knowledge and adoption of ICT developments;
- achievements in Computer Science (Informatics);
- developments in Computational and Data Science;
- an open setting for sharing data and software ("EOSC")
- a high-end e-infrastructure;
- skilled scientists;
- education and knowledge exchange through summer/winter schools;
- internationalization of high-level local courses and materials;
- availability of other resources for knowledge exchange.

What is the urgency, what is the message?

Today's challenges require today's methodologies and early adoption of future knowledge as well as the best deployments of skills, resources, up-to-date insights to get mastered. This in turn requires bundling all efforts towards eScience and proliferating the news ways of doing science over the whole research palette. PLAN-E represents a serious effort towards this bundling of forces.

Open Science requires more than sharing, it involves overarching insights in deploying whatever is available to do science and an open mind to do so.

The PLAN-E community has taken the challenge to drive this new direction forward and to address all issues that may help the promotion of eScience across all disciplines and all borders.

Contact

The PLAN-E website plan-europe.eu contains all the documents produced by PLAN-E or presented at PLAN-E meetings. It also holds the past and future dates of the PLAN-E plenaries.

The secretariat to PLAN-E is hosted by NLeSC (courtesy NLeSC), Science Park 140, 1098 XG AMSTERDAM, The Netherlands. Email contact p.aerts -at- esciencecenter.nl.