Abstract

This paper introduces the Quilt Interactive Publication platform, which can be used by computational scientists to publish their research results in the form of interactive publications. The platform will facilitate collaborative development and publication of such papers with the use of distributed computing resources. It will also be capable of retroactively processing existing publications in order to render them interactive and enable further refinement and reuse by collaborative research teams.

Keywords: interactive publications; high performance computing; e-Science; scientific publishing; beyond Web 2.0

1. Introduction

While recent decades have witnessed unprecedented progress in the area of computer-aided research techniques, the mechanism by which scientific advances are communicated to the general public has remained unchanged for more than a century: it is the scientific paper. The shortcomings associated with this mode of publication are well known: papers do not yield themselves to rapid verification, reproducibility and reuse of research achievements. The Quilt platform is an attempt at bridging this gap: just as the Web has come alive through the use of mashups and content embedding technologies, so too can research papers benefit from interactivity and dynamic content generation with Quilt.

2. Concept

The Quilt Platform operates by presenting the domain scientists with an environment which can be used to develop, test and run scientific experiments (expressed in a variety of programming languages). An outline of the Quilt concept is shown in Fig. 1. This environment bases on the GridSpace platform. While it facilitates all the functions expected of a programming environment, it also enables the developer to publish and expose fragments of the developed code (called snippets) as external, embeddable entities which can subsequently be visualized in a digital edition of a research paper. Such snippets provide interactive visualization of research results (backed by the underlying computing resources), enabling reviewers and readers to provide arbitrary input data and witness the published scientific algorithms in action, and to efficiently browse data sets which would be difficult to publish by standard means (e.g. attachments to standalone research papers). The environment will also enable generation of static snapshots of the papers being visualized, should a printout become necessary and it will provide a feature whereby existing research papers (in their source form) can be converted to an interactive format, whereupon further editing may take place. This feature is meant to assist researchers...
Fig. 1. Concept of Quilt support for interactive publications with a dedicated computing backend, enabling re-enactment and reuse of scientific experiments.

In switching over from traditional modes of publication to the Quilt platform and therefore resolve the take-up issues typically associated with novel approaches to the ways in which science is conducted.

The view presented by the Quilt environment to the end user (i.e. reviewer or reader of a scientific paper) takes the following form: the paper is served as a Web document in which static content is enriched by dynamically generated forms, representing the interactive part of the paper. The document contains embedded code snippets, each of which presents a visual interface to the end user (typically in the form of a diagram, graph, figure etc.). While the interactive publication is being loaded, each snippet executes on the engine server (which – if needed – can forward execution requests to underlying computing and storage resources). Moreover, results of such execution runs can be cached on the Quilt server if recalculating them on the fly would prove unfeasible (e.g. due to computation complexity or amount of data needed). As results arrive, placeholders are replaced in the paper view with actual results of computations. The authors of the paper are provided by a Web environment where they can code their experiments and determine the extent to which input data can be manipulated by the end user.

3. Conclusions

We believe that our experience with issues pertaining to e-Science and the tools developed in support of computerized research leave us uniquely poised to proceed in the form of a FET project. This solution could be used as a basis on which to pursue practical cooperation with scientific communities and publishers of scientific content, showing how the concepts outlined above are applied in practice and exploiting the tools available to both developers and readers of interactive publications.