

HepForge: a lightweight development environment for HEP software

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Abstract

Setting up the infrastructure to manage a software project can become a task as significant as writing the software itself. A variety of useful open source tools are available, such as Web-based viewers for version control systems, “wikis” for collaborative discussions and bug-tracking systems, but their use in high-energy physics, outside large collaborations, is insubstantial. Understandably, physicists would rather do physics than configure project management tools.

We introduce the CEDAR HepForge system, which provides a lightweight development environment for HEP software. Services available as part of HepForge include the above-mentioned tools as well as mailing lists, shell accounts, archiving of releases and low-maintenance Web space. HepForge also exists to promote best-practice software development methods and to provide a central repository for re-usable HEP software and phenomenology codes.

INTRODUCTION

In high-energy physics, software development is becoming a discipline in its own right. The community has benefited from the explosion in popularity of the open source software (OSS) paradigm and the many utilities developed in that spirit, with experimental collaborations beginning to deploy systems developed to aid management of distributed OSS development teams. Such systems include Web-based bug tracking software, a variety of version control systems and a plethora of “wiki” implementations. Various collaborations have deployed these tools to varying extents.

However, away from the large collaborations, few small research groups have the resources to investigate, configure and test such tools, which tend to require expertise in areas such as server configuration which are outside the remit of most physicists. This need for a substantial initial time-investment, combined with a reluctance to introduce unfamiliar new working methods, means that uptake of such systems is sparse among small groups.

CEDAR [1, 2] is just such a small collaboration. In developing our own software development environment for the JetWeb and HepData systems, it became evident that such an environment could be extended to set up well-integrated development tools for an arbitrary number

of similar projects with little replication cost. This system is called HepForge [3], so-named because it provides the same facilities for particle physicists that the SourceForge.net [4] service provides for general open source projects. Additionally, HepForge provides a convenient forum for central archiving of various re-usable HEP programs.

INTRODUCING HEPFORGE

HepForge is intended for use by small-to-medium sized HEP projects, specifically those with the intention to make their code re-usable, portable and documented. Very specialist code, such as reconstruction software written within experimental frameworks, is most likely unsuitable and should be maintained instead within the experiment’s code management system. Analysis routines, too, are typically unsuitable for HepForge: a system specifically designed for them is the PhyStat [5] repository. Project types suited to HepForge would be, for example, jet clustering algorithms, parton density function (PDF) codes and Monte Carlo event generators, and indeed projects currently using HepForge’s facilities include the KtJet library [6], LHAPDF [7] and a variety of event generators and related systems. Also suitable, but as yet unrepresented, would be e.g. statistics libraries and matrix element calculation codes.

Aside from the project management facilities provided by HepForge, we hope to encourage the uptake of more standard configuration and build systems within high-energy physics. An excellent example of this is the GNU “autotools”, comprising `autoconf`, `automake` and `libtool`, which automate many portability issues in code compilation and library management. These tools are ubiquitous in the open source world, and the familiarity of their build procedure is a major boon to developers on OSS projects, but they have yet to be widely embraced as part of the HEP software process. We hope that through HepForge more projects can be encouraged and helped in applying such tools to HEP purposes, if for no other reason than that such standardisation helps to integrate small tools into larger systems, encouraging code re-use, a traditionally weak area in physics software development.

Our intentions explained, we now move on to describe the features offered to suitable projects by HepForge.

HEPFORGE FACILITIES

The main design requirement of HepForge is that the initial learning curve for users should be very shallow. This

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includes not forcing a particular working pattern on the users: they may use as many or as few facilities as they wish, although the benefits of using multiple features are substantial.

The primary feature of any system for managing software development should be the facilities provided for managing the code itself. HepForge provides several such features, of which the first is the provision of the Subversion [8] and CVS [9] version control systems. Subversion is a modern replacement for the well-known CVS system and is highly recommended as it solves many of CVS's known problems. Both Subversion and CVS can be accessed via an anonymous read-only method and a read-write developer mode over SSH, as well as through Web-based viewers. Full-featured shell accounts can be provided for developers on request and a script is provided to help in conversion of a CVS repository to the more modern Subversion type. Additionally, the GNU Arch [10] and Darcs [11] distributed version control systems are available. Releases of project software can be archived and are automatically made available, sorted by version, through the HepForge Web interface.

Project management and source code are linked by the use of the Trac [12] bug tracker software, whose primary interface is Web-based. Trac allows projects to define development milestones, with due dates, and then for bugs (called "tickets") to be registered against a particular milestone. The ability of users to create, modify and close tickets can be controlled by the project administrator and developers can receive details of how bug fixes are proceeding by email. A defining feature of Trac is its strong integration with Subversion: projects using Subversion for their version control can automatically view the timeline of changes to the code and Subversion commit messages can be used to make automatic changes to the associated tickets.

Trac additionally provides a "wiki" system for collaborative documentation. Again, users' ability to view, create and edit wiki pages can be set by the project administrator, and the wiki pages can be referenced in Trac's tickets. While documentation is usually hailed as important but is nonetheless neglected, Trac helps to ease this problem by the close integration of the wiki system into the bug tracker and version control system. While Trac has been integrated smoothly into the HepForge system, users keen to customise Trac can do so easily, via a plain text configuration file, templates for Trac's Web pages and cascading style sheets (CSS) [13].

As well as providing facilities for managing software development, HepForge provides Web space for the public presentation of the project. The Web system is also designed for maximum convenience and is continually evolving new features. A project named, for example, "foo" will automatically have a HepForge Web page located at <http://hepforge.cedar.ac.uk/foo/>, with the full features of normal HTML and CGI scripts, including PHP and the Spyce inline Python engine. The displayed name of the project, for example "Foo", and meta-data such as a project

description, categories and keywords can be specified via an XML file: eventually this functionality will be available through the HepForge Web interface. Project Web pages are processed through a set of custom Apache 2 output filters, which can provide automatic headers and footers on all Web pages, will correct mistakes in HTML automatically, provide constants support in CSS files, hide email addresses from search engines and spam harvesters and allow the page source to be written in more relaxed syntaxes than HTML. Other filters in development will allow easy automatic highlighting of source code, inline rendering of LaTeX equations and support for more syntaxes.

Finally, HepForge provides mailing lists for projects: by default a list to allow users to contact project administrators and a list for announcements to users are created, but more are available on request. The lists can be configured by project administrators and list members can manage their own subscriptions.

From the point of view of the HepForge maintainer, most system tasks are managed via a carefully designed set of shell scripts, which render the system maintenance minimal. Common tasks, such as addition of new projects or users, are highly automated.

For small projects, HepForge offers several benefits over SourceForge and CERN's deployment of the related Savannah [14] system. HepForge provides full shell accounts and places few restraints on what users may or may not do. The Web interface, within the project areas, is almost entirely under the project's control. Useful features such as Subversion support, the highly usable Trac system and the Web filter system are unique to HepForge. The system is also in active development and many additional features are planned.

HEPCODE

HepForge will eventually be used to provide a final portion of CEDAR, named HepCode [15]. This was originally a project to provide access to well-defined versions of Monte Carlo generator programs, parton distribution functions and other high-energy physics calculation codes, but with HepForge the idea has expanded beyond phenomenology codes. In its current state, HepCode is simply a list of programs, with links to where they can be downloaded: eventually HepForge will be used to maintain and search this list and to archive released versions of the code.

CONCLUSIONS

HepForge is a new development environment for reusable high-energy physics software. It provides a range of useful facilities with an emphasis on ease of use and flexibility, and avoids the setup costs that such a system would impose on small projects. HepForge also aims to encourage the uptake of standard build systems and development methods in HEP software development.

HepForge currently hosts the core CEDAR projects

(JetWeb [16], HepML [17], HZTool [18], HZSteer [19], Rivet [20], RivetGun [21] and HepData [22]) as well as several external projects, including Herwig++ [23], ThePEG [24], Herwig 6 [25], Pythia 6 [26], LHAPDF [7], Jimmy [27], fastNLO [28], KtJet [6] and RunMC [29]. To date user feedback has been extremely positive. Other suitable projects are most welcome to join HepForge.

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