LAUREA

A more intriguing volunteer computing experience through Drupal and social technology

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Laurea-ammattikorkeakoulu **Tiivistelmä**
Laurea Leppävaara
Tietojenkäsittelyn koulutusohjelma
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Lauri Viitala

Kiinnostavampaa hajautettua laskentaa Drupalin ja sosiaalisen teknologian avulla

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Open Rendering Environment on Laurea-ammattikorkeakoulun vuonna 2008 aloittama projekti jonka tarkoituksena on luoda julkisen jaetun renderöinnin palvelu käyttämällä Berkeley Open Infrastructure for Network Computing (BOINC) ja Big and Ugly Rendering Project (BURP) teknologioita. Perinteisesti yksityishenkilöillä ja pienyrityksillä ei ole ollut saatavilla tarvittavia resursseja korkealaatuisen 3D-animaation tuottamiseen, mutta hajautetun laskennan järjestelmä BOINC tekee tämän mahdolliseksi.

Tämän opinnäytetyön tarkoituksena on tutkia sisällönhallintajärjestelmän tarjoamia mahdollisia hyötyjä BOINC-projektille. Open Rendering Environment-projektin tärkein lopputuotos, Renderfarm.fi-verkkosivut, on toteutettu käyttäen Drupal-sisällönhallintajärjestelmää BOINC:n tarjoaman Web-järjestelmän rinnalla.

Tutkimuksen teoriaosa käsittelee teknologioita, joita käytetään yhteisöllisten verkkopalveluiden rakentamiseen. Nämä teknologiat tarjoavat mahdollisuuksia sisällön luomiseen, vuorovaikutukseen ja käyttäjien väliseen yhteistyöhön. Tutkimuksessa tarkastellaan myös tapoja, joilla näitä web 2.0-teknologioita on hyödynnetty olemassa olevissa internetin taideyhteisöissä. Myös Drupal-sisällönhallintajärjestelmän toimintaa käsitellään.

Opinnäytetyön empiirisessä osassa on dokumentoitu Renderfarm.fi-sivuston nykyinen toteutus, painottuen Drupal-osuuteen ja siihen, kuinka se on saatu toimimaan yhdessä BOINC- ja BURP-järjestelmien kanssa. Tarkastelussa on Drupalin käytön myötä avautuneet mahdollisuudet käyttäjien välisiä vuorovaikutuksia tukevien teknologioiden hyödyntämiseen yhteisöllisen verkkopalvelun rakentamisessa. Tämän lisäksi haastateltiin Janne Juopperia, jotta saataisiin yrityksen näkökulma Renderfarm.fi-palvelun hyödyntämisestä. Juopperin yritys, 3D-verstas Oy, on erikoistunut tietokoneanimaatioihin, kuvaefekteihin, ja mallintamiseen.

Tutkimuksessa havaittiin, että Renderfarm.fi-sivujen nykyinen toteutus ei hyödynnä täysimääräisesti Drupalia. Sisällönhallintajärjestelmän modulaarisuutta hyödyntäen voitaisiin ottaa käyttöön enemmän teknologioita, jotka kannustavat ja luovat uusia mahdollisuuksia käyttäjien keskinäiseen vuorovaikutukseen. Hajautettu laskenta ja julkinen jaettu renderöinti toimivat lupaavana pohjana verkkoyhteisön rakentamiseen, mutta Drupalin tarjoamat lisätoiminnallisuudet antavat Renderfarm.fi-palvelulle mahdollisuudet suuremman yleisön saavuttamiseen hyödyntämällä web 2.0 -teknologioita.

Asiasanat: BOINC, sosiaalinen media, Drupal, Sisällönhallintajärjestelmät, hajautettu laskenta, renderöinti

Laurea University of Applied Sciences **Abstract**
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Open Rendering Environment (ORE) is a project launched by Laurea University of Applied Sciences in 2008 with the intention of providing artists and companies a source of computing power required for rendering 3D animations. These resources that have traditionally not been available to individuals are provided by the means of volunteer computing provided by Berkeley Open Infrastructure for Network Computing (BOINC) and Big and Ugly Rendering Project (BURP) technologies.

The purpose of this thesis is studying the possible benefits of using a web content management system alongside the BOINC provided website template. The most important end product of the ORE project is the Renderfarm.fi website, which has been built using the Drupal web content management system, extending the functionality of the BOINC website template.

The theoretical section of this thesis describes new technologies used on the web for creating dynamic sites that encourage user collaboration, content creation and interaction. In addition it describes how web 2.0 technologies are currently implemented on various web sites focusing on art. It also provides an insight to the Durpal web content management system, the functionality of different layers within it, and how it displays content.

The empirical section of the thesis first examines the current implementation of Renderfarm.fi, and focuses on how the Drupal component of the web site was built, what features it has and how it was integrated with BOINC and BURP. Furthermore, it examines the possibilities of further implementation of groundswell technologies for creating a community site. Also an interview was conducted with Janne Juopperi from 3D-verstas, a company focusing on creating 3D animations and modelling. The purpose of this interview was to provide a perspective for the possible commercial use of Renderfarm.fi.

It was found that the current implementation of Renderfarm.fi does not take the full advantage of what a content management system such as Drupal can offer. However using Drupal's modularity adding and removing features becomes relatively simple. Further integration of Drupal with BOINC and BURP would provide further possibilities of displaying content more dynamically. Volunteer computing and publicly distributed rendering are both technologies that can serve as a platform for connecting people in new ways. This potential can be increased by using a web content management system such as Drupal to help enable relationships between users and create a successful community website benefiting from social media applications.

Keywords: BOINC, social media, web content management, Drupal, volunteer computing, rendering

Contents

1 Introduction

Berkeley Open Infrastructure for Network Computing (BOINC) has provided a new tool for scientists, creating an alternative to expensive supercomputers normally needed for calculations and data analyzing requiring enormous amounts of processing power. This technology, called volunteer computing, has made it possible to create systems such as Big and Ugly Rendering Project (BURP), which utilizes BOINC in a new way for rendering 3D animations.

In 2008 the Open Rendering Environment (ORE) project was launched at Laurea Leppävaara. The ORE project aims to create a web service that makes it possible for users to utilize the power of volunteer computing for rendering 3D-animations and images. The project makes use of existing BOINC and BURP platforms as a base. This thesis investigates the use of a web content management system for creating additional value to a BOINC project. The focus is a set of technologies that help to build web communities that encourage interaction and collaboration between users.

At the time of finishing this thesis in May 2009, the ORE project is getting ready to launch Renderfarm.fi to the public. Some of the Ideas presented in this thesis are being considered for implementation. Even prospects of moving functionality from BOINC to Drupal, The web content management system being used, are pondered upon. Currently the focus of web site development in ORE is harnessing the full potential of a web content management system before opening to the public in the third quarter of 2009.

The potential processing power of volunteer computing far exceeds any supercomputer or computational grid. As the number of computers currently contributing to BOINC projects is just a tiny fraction of all the computers with internet access, the possibilities for growth are enormous. This technology increases public awareness of scientific projects, and gives the public a way to contribute to and have an impact on the general direction of scientific progress. (Anderson 2003, 2-6)

Volunteer computing has already had an impact on scientific progress. World Community Grid, funded and operated by IBM, maintains several BOINC projects focusing on humanitarian research. Several of these projects have already been finished. For example, the Human Proteome Folding Project has increased the knowledge about protein structure by providing valuable resources for scientists studying cell structures and diseases.

As David Anderson, the leader of the BOINC project, stated, the implications of the whole idea of volunteer computing can be social as well as scientific. It brings together like-minded individuals sharing the same interests to form global communities trying to reach common goals. In BOINC, the community aspect has been there from the beginning, with projects having active message boards, and volunteers contributing in many ways, like creating translations to web pages and providing additional software. An online survey was done about the reasons for participation in the original BOINC project, SETI@home. One of the important findings was the importance of public acknowledgement. BOINC projects keep statistics of individual user contributions by having leader boards on project web sites. In addition to this, it is possible for users to form their own teams, who can compete on their own leader board. (Anderson 2003, 1-4)

As this relatively small incentive for contribution was found to be effective, further possibilities for incentive schemes have shown up. In BURP and Open Rendering Environment, the way of encouraging contribution is making users earn "credits". When a user contributes computing power to a render job, he earns a certain amount of credits based on the level of resources he has contributed. These credits are stored within the server system, and can be later used by the user for submitting his or hers own render jobs for others to compute.

2 Background

The subject of this section is the background of this thesis and the ORE project. It describes the initial situation and the progress made in the project at the time of starting the thesis, and connections to other projects, resources and collaborative groups. This section describes the reasons behind writing this thesis. It also describes the objectives of this thesis, as well as the objectives of the ORE project in general.

2.1 Initial situation

When the process of writing this thesis had just begun in December 2008, Renderfarm.fi was in the middle of a beta testing phase. The project website had been built with Drupal, a web content management system, which is working together with the BOINC-provided web template. The solution had not yet been evaluated for its feasibility and possibilities of adding more features had not yet been thought over.

2.2 Need for development

BOINC-projects in general have a readily made template intended to be used as a basis for the web site of any particular project. The template has all the functionality a BOINC project needs, like statistics, forums etc. Project administrators can add content and functionality as required by a particular project. This template could be used as a base for creating additional features. Also using a separate system to build upon can be considered as an option.

Instead of focusing on processing and creating scientific data like most BOINC projects do, ORE produces 3D animations and images that are easily understandable to the general public. As the target group of the web service is mainly 3D artists, The ORE project has additional possibilities for the project website in terms of features, interactivity, usability and visual appeal. The fundamental difference between ORE and other BOINC projects is that instead of individual users donating their CPU time for the benefit of the greater project, they are getting something in return, in this case processing power to render their own work. Also in ORE, BOINC teams can earn credits too.

In the last couple of years, a new breed of user-centered web applications and services have emerged and become extremely popular. These sites are built around a new set of principles and practices that focus on user participation, collaboration, communication and creativity. These principles have been collected under an umbrella called web 2.0. (Madden & Fox 2006, 1.) Because of the increasing popularity of services making benefit of these new ideas, it is important to study the possibilities for benefits regarding BOINC projects. As sites like DeviantArt and Flickr provide diverse features for content creation and communal possibilities, and Digital encyclopedias like Wikipedia are providing a new way to share information with everyone with access to the World Wide Web, the demands of internet users are changing as they expect other web services to have similar functionality. For a user oriented web service such as Renderfarm.fi, this should be taken into consideration.

According to David Anderson, the founder of BOINC, that one of the long-term goals of the project is increasing participation so that BOINC runs on most of the computers of the world. This could be achieved by making participation easier. Knowledge needed for system administration and database expertise could be reduced, so that creating and operating BOINC projects would become easier. (Maurer 2005, 25.)

The use of a Content management system together with BOINC might be able to address some of the issues mentioned. Also using BOINC for popular culture has so far been uncharted territory, and can become a small contribution to achieving one of BOINC's main goals stated

by the founder of BOINC, David Anderson: “Reducing the barriers of entry to volunteer computing” (Anderson 2004, 2). The possible integration of Drupal web content management system and BOINC has already stirred up discussion in the official BOINC message boards, with several BOINC projects looking into prospects of using Drupal.

2.3 Objectives

The purpose of this thesis is to find out if a web content management system can add value to a BOINC project, ORE in particular. This Thesis will try to answer the following questions:

- How can a community site focusing on art benefit from social media?
- Is Drupal an ideal community-building tool for Renderfarm.fi?
- What further possibilities does Drupal offer to improve Renderfarm.fi?
- Has the addition of a second system been beneficial for the ORE project or has it created additional problems?

2.4 Objective of the ORE project

The objective of the ORE project is to create a web-service for publicly distributed rendering by using existing BOINC and BURP technologies. BURP serves as a demonstration of the technology that enabled BOINC to be used as a system for distributing rendering jobs, and Open Rendering Environment aims to be the first service that introduces this system to a wider audience. As BOINC has been traditionally used in projects focusing in scientific research and calculations, BURP and ORE are the first BOINC projects that concentrate on popular culture, and the wider target audience has been taken into consideration.

2.5 Confining the work

Originally it was intended to try out several different web content management systems for their suitability to work with BOINC and Renderfarm.fi. This was abandoned, because Drupal has already been implemented, and trying out others would be time consuming, and satisfactory results would be unlikely with no thorough testing. However, when planning the project website, other web content management systems were considered. Also, the testing of the BOINC supplied web site template was abandoned. The distinction between functionality provided by BOINC and Drupal in the current implementation was thought clear enough to show what functionality the BOINC supplied web site has alone. The BURP website also gives a clear picture of what the capabilities are without Drupal, although this is limited to the user point of view, as the administrative side is out of bounds.

2.6 Research method

The Research method used in this thesis will be constructive, as the research problem can be thought as a question of improvement, and finding out if the use of a content management system can create additional value for a BOINC project.

2.7 Resources and collaborative groups

Financial resources will not be needed, as a personal computer can be used as an environment for further testing of BOINC and Drupal. As both BOINC and Drupal are open source software, they can be downloaded from the Internet without cost. Additionally, the server software that BOINC and Drupal needs, are also Open Source and can be used free of charge. Apache will be used as the Http server, working together MySQL database software, and PHP server-side scripting language. The current implementation of Renderfarm.fi can be found online and accessed at the www-root level and at the server operating system level if needed, but permission of the ORE project group must be granted first.

2.8 Connection to other projects

ORE is based on a similar BOINC-project called BURP, which was the first project that aims to create a system for publicly distributed rendering. BURP is currently in a testing phase and is not yet considered a fully functional BOINC-project. The ORE-project uses BURP as its base for additional functionality that has been built on the BOINC-web platform. Most importantly ORE borrows the system that enables render jobs created with Blender to be split into pieces, rendered at client computers, and re-assembled at the server. This is the base that ORE builds upon to create a fully functional community web site for rendering.

3 Focal concepts

3.1 Volunteer computing

Volunteer computing, also known as public-resource computing, is a way of using the resources of personal computers owned by the general public for supercomputing. Instead of specific supercomputer centers, the vast majority of the world computing power resides in millions of personal computers all over the world. The owners of these computers decide which volunteer computing projects they want to contribute their resources to.

Volunteer computing is different from grid computing. Grid computing uses computers operated and managed by a single organization, such as a university or a company. Because of

this, the resources can be trusted, and no result falsification is expected. In Grid computing, project related screensavers are unnecessary, as client deployment is automated and there is no need for an incentive for the user. The means of gaining volunteer computing power also different, the public needs to be persuaded that the goals of the project are worthwhile to justify contribution. (Anderson 2004, 1-2.)

3.2 BOINC

BOINC (Berkeley Open Infrastructure for Network Computing) is a platform for volunteer computing enabling easy creation and management of volunteer computing projects. BOINC can be used for diverse applications, thanks to its flexible scaling mechanism for data distribution, and efficient scheduling.

BOINC consists of a server system and a client program. These two communicate with each other to distribute, process, and return work units. The server system consists of a relational database for storing all the necessary data, scheduling server for managing remote procedure calls from clients, and a data server for handling and certifying file uploads. The BOINC client program handles the work on the client side as either a screensaver showing application data, as a windows service which doesn't require a user to be logged in, an application showing project related data, or a UNIX command-line program.

As an incentive scheme, BOINC has a system for awarding users with credit, measured by the amount of computation a particular user has contributed. BOINC has also has a mechanism for preventing ”cheating”, so users get only credit for validated contributions. Credit statistics can be displayed and visualized on the project website or a possibly a screensaver included with the client program. (Anderson 2004, 1-2.)

3.3 Web content management system

A Web Content Management System (CMS) is software used for managing, controlling and developing a website. Typically a web content management system stores content in a database, which is fetched dynamically when needed, and presented to the user who has requested the particular piece of content via a web-browser. Typical functions for a web content management system are user control, content creation and editing, and other maintenance and administrative functions. Using a web content management system usually doesn't require knowledge of programming language or substantial technical expertise, as all functions can be accessed with a web-browser.

3.4 Drupal

Drupal is a modular open source web content management system distributed under the GNU general public license. Drupal can be used for a wide range of purposes, such as web portals, personal blogs, E-commerce applications, and social networking sites. It is maintained and developed by a large community of users and developers, who provide hundreds of freely available modules to extend the available features. Like other web content management systems, Drupal stores content in a database and presents it to the user whenever it is requested by a web-browser. (About Drupal 2008.)

Drupal is just a single part in the server architecture, and requires additional components to function. The other required components of the technology stack are:

- Server computer
- Operating system
- Database
- Web server
- PHP

(Technology stack 2009.)

3.5 Web 2.0

Web 2.0 is a conceptual term popularized by O'Reilly Media and MediaLive International which is used to describe a new generation of participatory web applications such as blogs, wikis, and social networking sites. Some of the key characteristics of web 2.0 are considered to be the user's ability to control their own data, utilizing collective intelligence, and providing user interaction in services. There is still a lot of disagreement on what Web 2.0 actually means, and the separation of Web 1.0 and 2.0. (Madden & Fox 2006, 1-2; O'Reilly 2005.)

3.6 Rendering

Rendering is the computing process of creating an image from a model. It involves calculating lightning, texture, geometry, shading and viewpoint information in order to produce a final and fully realized visualization of a particular scene. A sequence of images, typically 25 per second, can be used to create an animation. Depending on the complexity of the scene, the rendering process can take a long time to finish and require substantial amounts of processing power. (Hess & Roosendaal 2007, 23-24.)

4 Social media and the Groundswell

Li and Bernoff describe in their book, "The Groundswell: Winning in a World Transformed by Social Technologies", the behavioural change online caused by social media. They dubbed this phenomenon as the Groundswell: "A social trend in which people use technologies to get the things they need from each other, rather than from traditional institutions like corporations." (Li & Bernoff 2008, 9). They also describe the technologies that enable this power shift by connecting people and creating communities. The groundswell is described as being focused on relationships, while technologies work just as enablers. These Groundswell technologies are presented in this section.

4.1 Users creating content

Tools allowing users to create their own text, audio or video are widely available and easy to use. Various technologies allow people to publish their own content, or search for something made by others. YouTube has grown to one of the most popular sites on the web, allowing people to publish their own videos for others to watch and comment. Podbean.com and other podcast sites do the same for audio streaming, allowing users to use software such as iTunes to listen to listen to the podcasts by web syndication. Blogging is another form of users creating their own content, by creating online journals. The content published on sites mentioned before allow the building of relationships between users, the focus of the Groundswell according to Li and Bernoff (2008, 19-20). When authors of different blogs read the ones of others', they comment and link each other and thus the blogosphere: an interlinked network of blogs. Li and Bernoff (2008, 20) mention that user created content threaten institutional power by not being regulated. All kinds of opinions and points of views are published, and many of the videos in YouTube violate copyrights.

4.2 Social networks

The popularity of social networking sites on the web has exploded in recent years with Facebook and MySpace emerging as the most popular ones, even though many others exist too to suit audiences with particular interests. These sites thrive by maintaining profiles of registered users, and allowing them to interact with each other by adding other users as "friends". Facebook provide a convenient way of keeping up with recent activities of Friends by a news feed. Facebook also enables relationships by sub-communities called groups. These groups collect users under a common interest, curling for example, which has many dedicated groups with the largest one having more than 3000 members.

Facebook even has a framework to allow developers to create their own applications. Thousands of applications have been created to extend the core functionality of Facebook, providing rich and diverse content to suit even users with more unusual interests. Social Networking has reached the level of popularity that many companies use it for reaching potential customers. Social virtual worlds such as Second Life are a step further from more traditional social networking, where users can explore and interact in a 3D virtual world.

4.3 User collaboration

The most visible form of user collaboration on the internet are wikis. These websites allow users to create and modify content with a mark-up language that allows basic formatting of pages, and interlinking them. Wikipedia is the largest of these sites, an online encyclopedia with more than 2 million articles. In Wikipedia, only registered members can create new pages, but anonymous users can edit existing ones. Because of this open nature, one would assume that varying points of view of different users would result in chaos, but Li and Bernoff (2008, 24) state that in most cases the collective contributions represent a view based on shared conventions, neutrality being the main one in the case of Wikipedia. The reliability of the information in Wikipedia has often been questioned. Relationships are created in wiki environments by having a discussion page for each article where users can comment the article and the changes made to it. According to Li and Bernoff (2008, 25), Wikipedia is a classic example of the power shift from institutions to people, as the Wiki pages of these institutions, no matter whether they are political, economic or religious, often include criticism of their actions.

Open source software development also benefits from similar collaboration. This allows anyone to participate in testing and improving software, because the source code is available for anyone to see. Sourceforge.net is the best known web community for Open source developers, and provides web hosting for projects in addition to various tools for revision control and project management. Sourceforge also hosts other applications that can be used by the projects, such as wiki tools, bug tracking, web analytics, surveys, image gallery, guestbook and blogging. Visitors can search through the projects and download the latest versions. In February 2009, Sourceforge claims to host more than 230,000 registered projects. Open source can be a part of the groundswell too, as people collaborate to create software for their own needs, instead of relying on the ones that are corporate provided. The effect can already be seen with some of the most popular pieces of software such as Firefox, Apache HTTP server, and the Linux kernel are licensed under open source licenses. (What is SourceForge.net 2009.)

4.4 Users reacting to each other

Forums have been around for a long time allowing users to discuss various topics on the internet. Posted messages are organized in "threads", groups of messages under the same topic. Sometimes forums are not moderated by anyone, and others have moderators assigned by site administrators to make sure the discussions follow predefined guidelines to avoid inappropriate posts. Usually only users with registered accounts can post, but on most forums all visitors are allowed to read them. Forums enable relationships when users who frequently post on the same subjects get to know each other by having these conversations. The users that participate a lot on discussions tend to build reputations, some positive as experts and others negative, troublemakers for example.

Another way of users reacting to each other is reviews and ratings. Electronic commerce has made use of reviews for quite a while, with sites such as Amazon.com using customer reviews on products to rate them on a five star scale. As this way of reviewing has become more popular, and is today present in almost every major online shop, the companies creating these products have to take these ratings into account in addition to expert reviews that were only available before.

4.5 Organizing content

Tagging has become a popular way to organize content on the web. Tags are keywords that users assign to bookmarks, images or other pieces of information. These tags help to classify in sites such as Digg, a site where people share content from the web such as news articles, and vote for the ones they like. With the help of these keywords users can find news related to the original post, with the same tag. Technorati is a search engine that indexes blogs on the web. Users can search for blogs by tags that the bloggers have assigned to their posts. Some sites like to visualize user generated tags as "tag clouds", where the most popular tags are bigger than the rest, showing which categories have the most content or which keywords are the most searched (Otala & Pöysti 2008, 34). Shortly, tagging helps people find information they like.

Li and Bernoff (2008, 30)claim that tags can work as a form of self-expression, as user can tell what he or she thinks of a certain piece of information by what kind of a tag he or she has given it. This also threatens institutional power as people can tag products anyway they like, and companies have no control over it.

4.6 Syndicated content

As there is a lot content floating around the web, help might be needed to easily access the correct information. RSS – short for Really Simple Syndication, provides the means for users to receive the information they want, in the form of updates. An RSS feed can include snippets of any new content on a site, like blog posts or news articles. Instead of having to visit the sites or blogs the user wants to keep an eye on, he or she can simply subscribe their RSS feeds. These feeds from different sites will be collected to a single location, the RSS aggregator. The aggregator can be a piece of software or a web application. By viewing the RSS aggregator the user can view all the feed he or she has subscribed to, and click on the most interesting items for viewing the complete web page the feed refers to. Subscribing is easy, it can be done by clicking a small orange icon at the end of the URL bar on the browser or on the web page. According to Li and Bernoff (2008, 34), RSS feeds themselves don't enable relationship's, they make social activities more efficient when users can monitor more content on social networking sites and blogs.

4.7 Social technographics

Forrester Research Inc. does consumer surveys based on their technology behaviors, which they call social technographics. Pondered also by Li and Bernoff (2008, 39-45), they categorize people in six different groups according to their social technographics profile. These groups are placed on a ladder, with the groups on the top contributing more on the Groundswell phenomenon, described earlier in this section, than the ones at the bottom. Each person can belong to one of these groups, or many of them. The different groups in the social technographics ladder are visualized in Figure 1. These groups presented by Forrester Research Inc. include:

- Creators are the people who at least once a month publish web pages, blogs, upload their own videos to sites such as YouTube, or upload audio, podcasts and such.
- Critics are people who comment on the content created by the creators. They also post ratings and reviews on sites such as Amazon. They also use forums and chat rooms for discussion.
- Collectors subscribe to web feeds to accelerate their consumption of content. They also categorize content created by creators and critics on the web by tagging.
- Joiners have profiles on social networking sites such as Facebook and Myspace. They use these sites.

- Spectators consume the content made by others – they read blogs, watch videos on YouTube, listen to podcasts, write on message boards and read ratings and reviews made by critics.
- People doing none of the above are considered inactives, they have yet to participate.

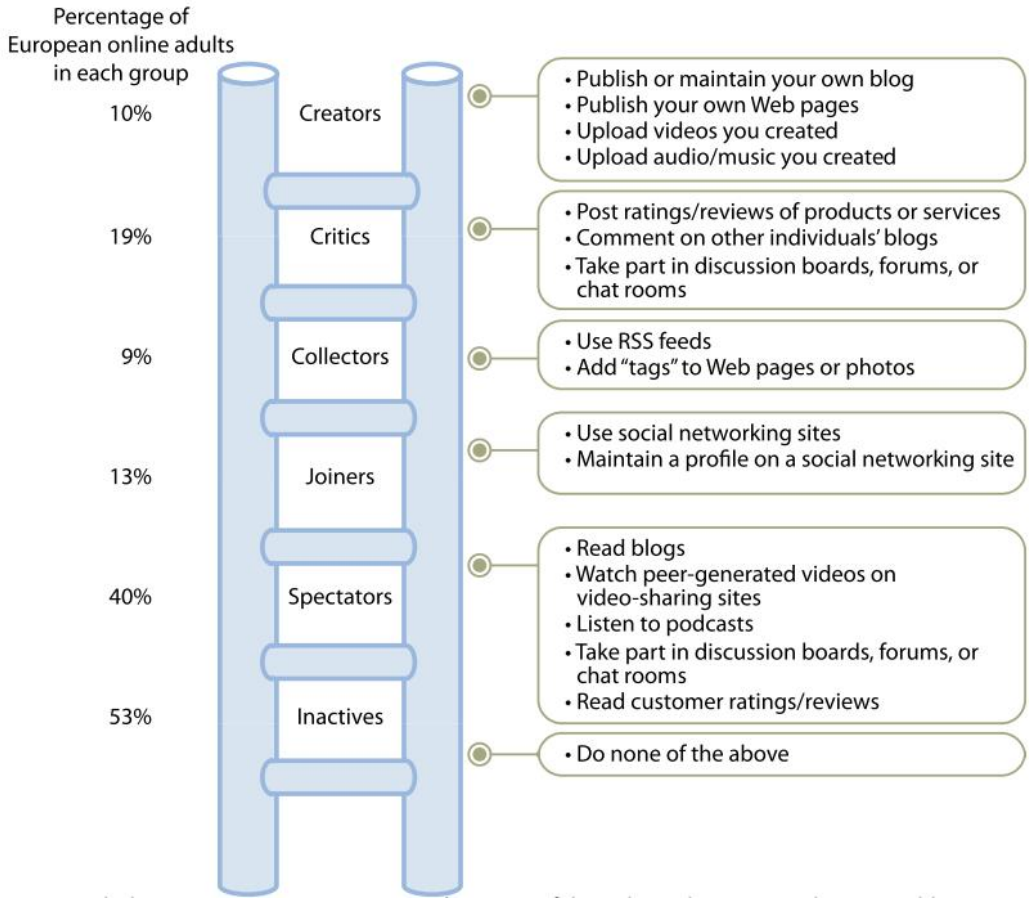

Figure 1: The social technographics profile of online Europeans (Forrester Research Inc. 2008, 2)

As shown in the social technograhics ladder in Figure 1, half of the European online adults are still considered inactives, and collectors are the smallest group with less than 10% participating. The amount of critics is surprisingly high, with 19% commenting, rating, and reviewing products and works of others. Even though only 10% are considered creators, it still ensures that a huge amount of content is available in the form of blogs, videos, home pages, and podcasts. Figure 2 reveals the same statistics from online adults in the United States, where people participate more in groundswell activities than in Europe. It also shows the difference between statistics from 2007 and 2008: participation has increased rapidly, especially within critics and spectators, while the amount of inactives has nearly halved.

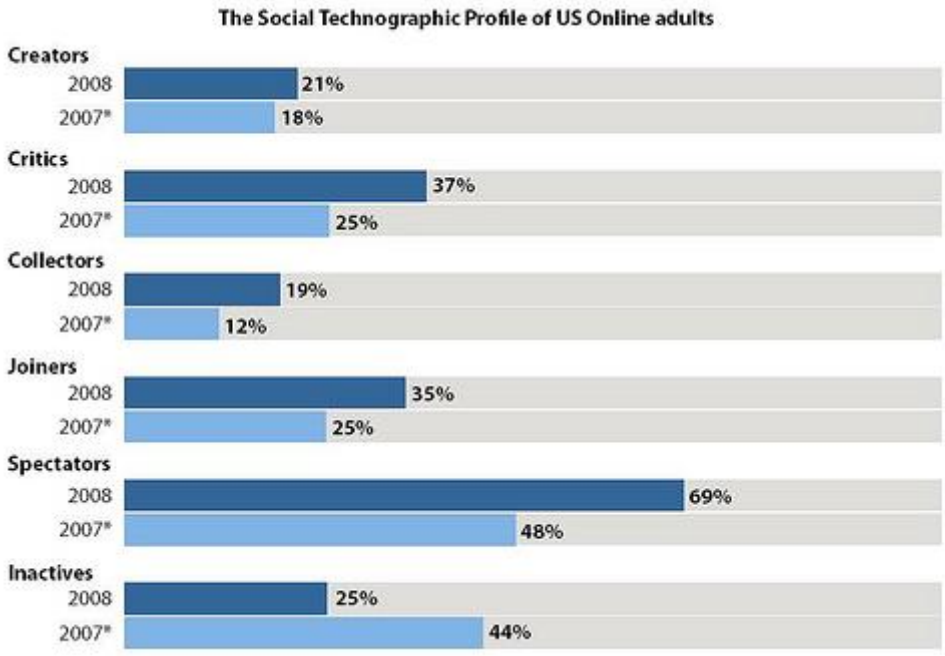

Figure 2: The social technographics profile of US online adults (Forrester Research Inc. 2007-2008)

5 Web 2.0 and digital art

In the paper "Art meets Web 2.0 trend", Christodoulu and Styliaras examined the potential use of web 2.0 technologies in online art communities and art projects. These technologies have been implemented to enhance user interaction and collaboration on many sites dedicated to Digital music and video, online art installations and digital photography to name a few. This section describes some of these web 2.0 applications presented in the paper and their current implementations on art sites.

Wiki platforms are used for creating art related encyclopedias. Sites such as art.wikia.com are Art wikis, collaborations allowing users to share information about art accessible to all. artwiki.wikidot.com is a repository containing tutorials for all forms of arts. As of now, most of the content is off-site, with just links to tutorials on other sites, but it serves as a useful directory for beginners searching for information.

Social Virtual Worlds, such as Second Life, can also be used by artists for promoting their work, participating in art events and visiting galleries. The modelling tools included are used to create art that exists only in the virtual world, with many Art installations from interactive exhibits to sculptures that benefit from the three-dimensionality of Second Life.

Art related blogging in the internet has become popular as blogging can be useful for artists searching for ideas and inspiration, or just willing to share their work for others to see. Artlogs are blogs that focus on art work and can include anything from images, music, photos, videos, or anything else artistic. The way how Artlogs differentiate from just blogging about art, is that they focus on the art work itself, not text about it. The site artlogs.org allows users to publish their own Artlogs and lists them for other users to browse through. When one finds an Artlog he likes, he is bound to visit it frequently for new material and possibly comment on the works, eventually helping to create a small fan base for the artist. Subscribing to an RSS feed of a particular Artlog can help a user to keep up to date about new work from the artist.

5.1 DeviantART

Much like in artlogs.org, social networking sites allow users to connect with other users interested in art. There are also specialized social networking sites dedicated to art, one of the most popular being DeviantART. Launched in 2000, DeviantART is a meeting ground for artists to show their works and discuss them, review art from other users and rating them. . The site has 10 million registered users, with 100,000 new submissions daily ranging from photography to traditional art and poetry. The site has an interface allowing users to browse through various categories of art through a simple hierarchical menu for searching recently submitted and top rated artwork. Instead of browsing, one can use the Sitback application to watch a slideshow of deviations (pieces of art submitted by a user. DeviantART also features an online shop that allows users to promote and sell their art printed on everything from t-shirts to coffee mugs. DeviantART offers the option for a Premium subscription against a small fee, allowing add-free browsing, more customization options and improved features.

DeviantART allows the customization of profile pages to a certain extent, so users can create a personalized look and feel for their profiles, something very appropriate for an art related site. Different features are described as Modules, and can be freely moved around, added, or removed on the profile page. Some of the different modules include Featured Deviation, favourites, Journal and even a module exists for showing an image from your webcam.

Information on a users profile can be displayed off-site by adding what DeviantART calls “pasties”, snippets of HTML code that one can add on his homepage or where ever he wants to exhibit his activities in DeviantART. Users can create their own polls, and vote and comment on ones made by others. The most popular polls are listed on the site, with many reaching several thousand votes. Other users can be added to a Watchlist that gives notifications whenever a user on the list adds new art, posts news items or blog entries. The users with the most page views are listed on the site as Popular Deviants. In addition to just

adding art to favourites, one can organize them into collections, which work like folders. When intriguing work is found on a user's gallery or anywhere else, it can be simply dragged and dropped to a small collection box that can be opened from the top navigation bar. As collections themselves are considered as pieces of art, they can also be commented on. Daily Deviation is a staff-maintained feature, where an assortment of particularly impressive or interesting submissions are chosen to be given special attention, in order to be viewed and commented by the entire community.

In addition to message boards, DeviantART uses a set of technologies called dAmn – deviantART Messaging Network. dAmn is used for real-time messaging and consists primarily of a chat network, with official and unofficial chat rooms. The official chat rooms are moderated by administrators, but the rest are user made, as everyone who is registered to the site can create a chat room. The founder of the chat room can define the rights of guests, members and operators, such as whether they are able to set topics or kick other users. Part of dAmn is also a shoutbox, a popup browser window where users can quickly leave messages, or converse with each other.

5.2 Collaboration

In contrast to the traditional assumption has been that art is created by a single artist, larger art projects usually require collaboration of several artists. Many online art collaborations exist, such as Zoomquilt.org, where images created by different artists are embedded into one another to create an image that can be zoomed infinitely. Webcanvas.com provides users an endless canvas where they can paint and have a look what others have created. Users can upload existing images on the canvas or use basic drawing tools to create their own, thus taking part in what is supposed to become the world's largest collaborative painting.

In particular movies, be they made traditionally or digitally, are generally larger productions that involve many people in different roles. In 3D animations these include artists, animators, composers, directors, in larger productions even producers, technical directors and art directors. Even work on a single 3d model can be split in to several different tasks such as texturing and modeling. When all the individuals working on the project live in geographically different locations, some sort of collaborative environment can help to ensure the team can communicate more efficiently.

Currently the front runner in online film collaboration is Wreck A Movie (wreckamovie.com). Wreck A Movie provides a web platform and a community around collaborative film making. The site aims to encourage film viewers to participate in production, and start their own film projects. This crowdsourcing and using the internet as the means for distribution help to

lower production costs and accelerate production cycles. The productions in Wreck A Movie range from animations all the way to full-length feature films. In Wreck A Movie contribution is simple. Different productions are divided into tasks, where registered users can add "shots", contributions including ideas and media files. (About Wreck A Movie 2009.)

6 Drupal

This section serves as an introduction to the Drupal, and it's strengths that lie within the ability to customize and configure extensively. It describes the layered and modular structure of the web content management system, and takes a look at the way content is arranged and displayed to the user. Finally, this section explains what the benefits of active community support are.

6.1 The Drupal flow

The data flow within Drupal can be divided into five different layers (see Figure 3). At the bottom of the stack is the data pool, with all the actual content that is to be displayed, such as nodes. Nodes are the basic building blocks of a Drupal site, pieces of data with a Content Type, Node ID, title, body, date of creation, and an author. The next layer contains the Drupal modules, which provide all the functionality for the site. This is followed by the block & menu layer. Blocks are used for displaying output from modules with various configuration options. Menus are used for navigation within the site. This is followed by the permissions layer, which defines what content and functions a certain user role is allowed to view and access. The permissions are configured on different user roles, such as guest, registered user and privileged user. On the top of the stack is the template layer, consisting of CSS, PHP and XHTML, all used for displaying content on the correct places on the template. (The Drupal overview 2009.)

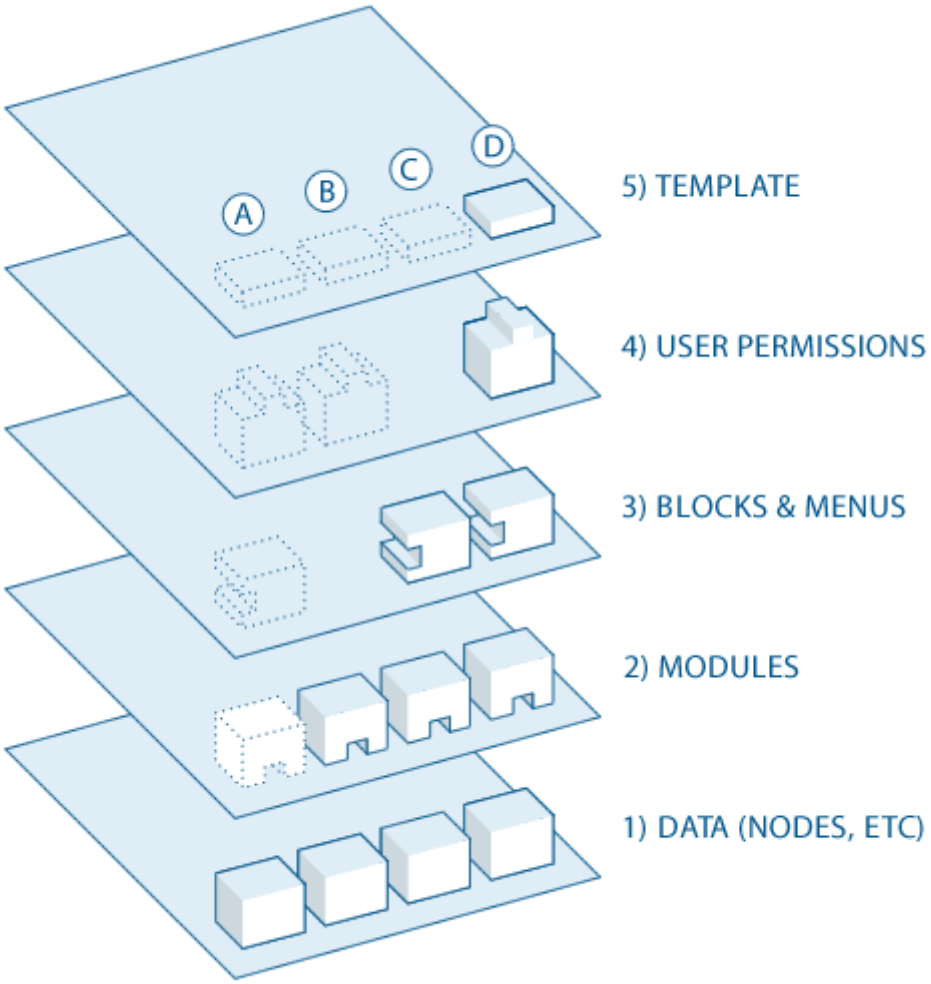

Figure 3: Drupal layers (The Drupal overview 2009)

6.2 Modularity

Drupal provides great possibilities to extend functionality by installing and enabling additional modules. The Drupal core provides basic functionality that can be built upon by adding modules written by the Drupal community, as shown in Figure 4. The modules provided by the community are freely downloadable from the Drupal website. Modules can be for example small applications like the RSS-aggregator or the site forum. Some of the modules are dependent of functionality provided by other modules, and cannot be used unless the modules they rely on are enabled. Parts of the Drupal core cannot be disabled, but all of the optional modules can be turned off by the administrator. This way, an administrator can

precisely select what functionality is needed, and disable the modules that are unnecessary to speed up the site.

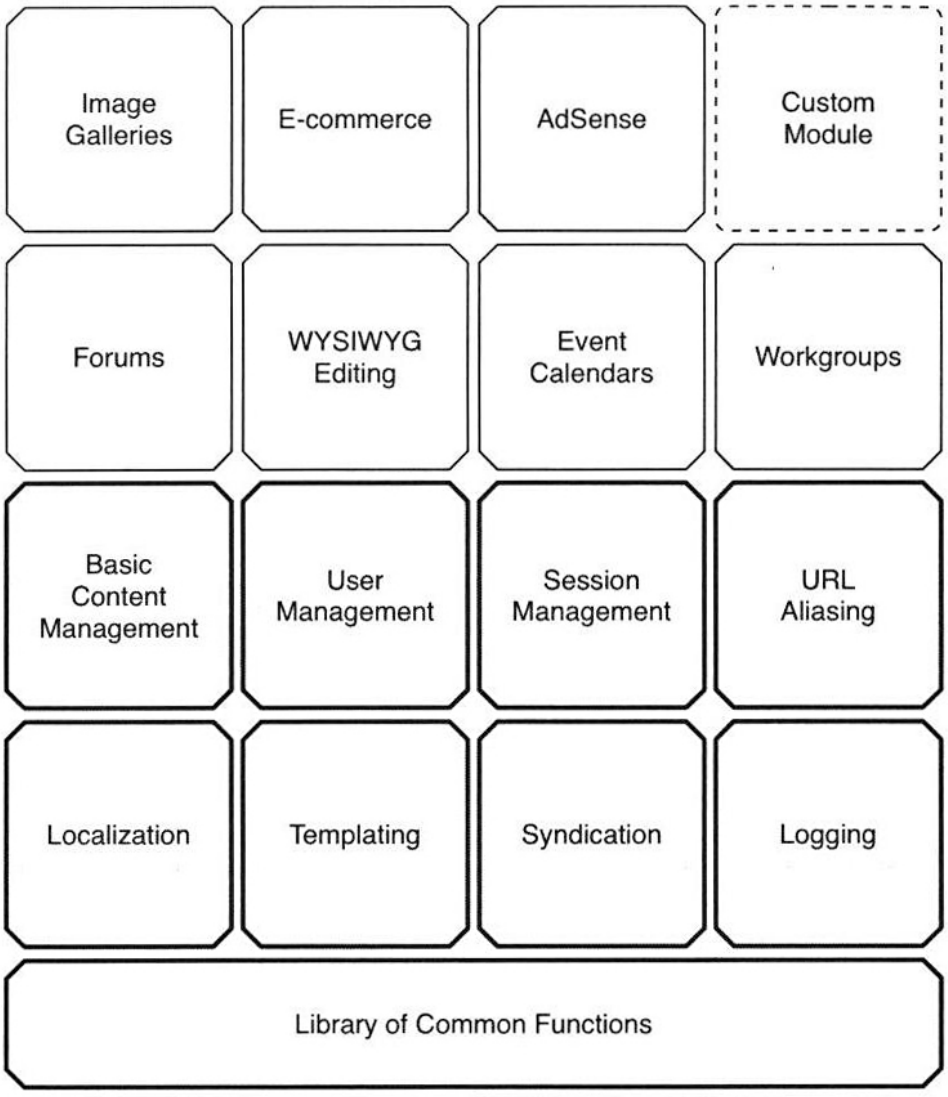

Figure 4: Drupal core functionality extended with additional modules (VanDyk & Westgate 2007, 4)

6.3 Theming, blocks and regions

In Drupal, themes are a set of files that define the visual aspect of the website. theming is responsible for creating the required html for users to view via a browser. When data is called, the theming files set the styling, placement and positioning of the content displayed. A large collection of themes can be downloaded directly from the Drupal web site.

Administrators can customize these downloadable themes by editing the CSS and PHP files included in them, creating a personalized look and feel for their web sites.

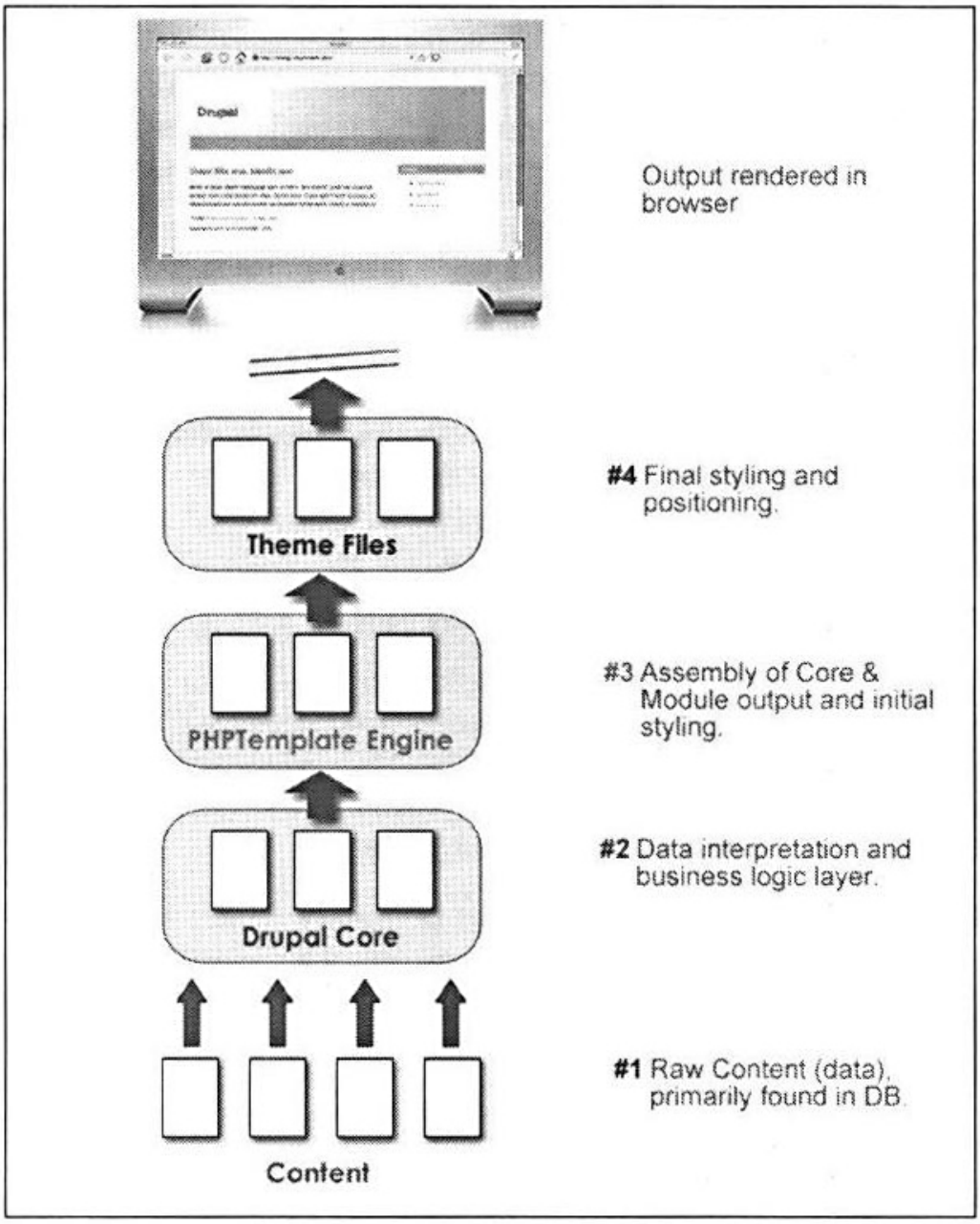

Figure 5: Content displaying process in Drupal (Shreves 2007, 11)

Drupal themes divides the contents of the screen presented in different sections called regions. The place of these regions can be changed by editing the code in the appropriate theme files. In these regions, elements called blocks can be added displaying information by a specific module, such as a content menu, or a list of recent blog posts. These blocks are

typically placed in side bars on the left or right side of the page, depending on the regions of the particular theme. The output of these blocks can be customized for different user roles, for example menus having additional items for site administrators. The main content area where page content is displayed, typically in the middle of the page, is also a region. Typically also a header and footer are assigned their own regions. Blocks can be easily added or their placing in the theme can be changed by site administrators with no access to the code of the theming files. The process of displaying content to the user is shown in Figure 5. (VanDyk & Westgate 2007, 10; Shreves 2007, 5-20.)

6.4 The Drupal community

Drupal is one of the most popular web content management systems available, and as open source software, has very fast development cycles with several updates every year. Drupal has a large community with active forums for discussion and searching help. The Drupal community has also contributed a vast amount of add-ons for use to anyone. As of 21.1.2009, The Drupal website has 5817 community contributed modules available for download, taking into account all versions. The functionality of these modules range from user management to e-commerce, and very specific functionality is available, it is just a matter of finding the correct module for your purpose from the extensive list. However, it is worth noting that several of these modules are still under development and have no version recommended to be used on a live site. The community also maintains and creates new translations to different languages for Drupal. As default, Drupal is shipped with English, but translation files can be downloaded and enabled using the localization functionality provided by the Drupal core. As of 21.1.2009, The Drupal website has translations for 53 different languages. Drupal also has a dedicated security team who notifies and raises awareness about vulnerabilities and security issues. The security team also creates security updates for Drupal administrators to download when needed.

7 Renderfarm.fi web site development

This section explains the current implementation of Renderfarm.fi, and the way Drupal was made to work with BOINC. The most important features are explained and effort has been made to draw a line between features supplied by BOINC, BURP and Drupal. Also all the major issues concerning site development have been included, mainly regarding the relationship between BOINC and Drupal. Performance tests were not given much focus as performance has not been given any attention at this stage of site development. They are only intended as an early comparison of Renderfarm.fi and a BOINC site.

7.1 Considering using a content management system

In July 2008 The ORE project team decided to use a content management system to help website development. It was thought that this solution would make possible to develop the site with little technical expertise. Also the visual appearance of the site could be easily changed by using a readily made template as a base. One important requirement for the content management system was that it should be written in PHP, allowing better integration with BOINC. Drupal was chosen to be used as it provided more flexibility than other content management systems. Other content management systems considered were Joomla! And WordPress, but these didn't seem to provide enough possibilities for extension. Drupal had several advantages that supported this decision. It could be used on the same LAMP (Linux, Apache, MySQL, PHP) environment as BOINC, as both systems could work with the software that was intended to be used on the server. The LAMP stack used on the server can be seen from Figure 6. A choice was made to use Drupal version 5 instead of version 6, mainly due to a lack of available modules for the latest version. However, Drupal 6 has some additional features not available in the earlier version, but these were considered unimportant, as Drupal 5 still provided more functionality because of its vast collection of user created modules. Drupal 5 still has maintenance and security updates, but no new features are added. Installing these updates is simple, but a migration to Drupal 6 or the soon to be released Drupal 7 would require changing the modules to support the correct version.

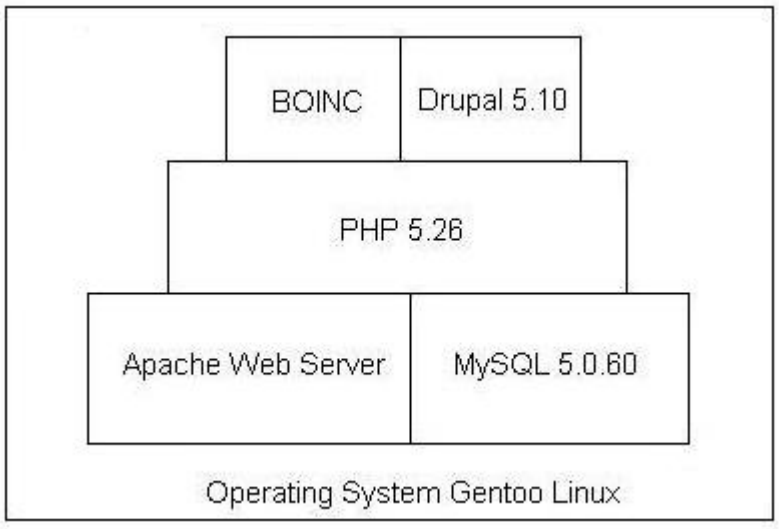

Figure 6: Renderfarm.fi Server stack

7.2 Drupal and BOINC integration

Initially, the problem of using BOINC together with a content management system, was how to make the two systems work seamlessly and switching between BOINC generated content and Drupal generated content invisible to the user.

The original plan was to write a wrapping framework for wrapping BOINC URLs into URLs that can be controlled from within Drupal. This would have required that all the BOINC PHP files needed to be changed to link to the appropriate URLs. Later it was found that Drupal has URL aliasing included at its core. By using this module, it was just a matter of creating a Drupal page for every BOINC PHP file with an URL alias pointing to the original path of the PHP files. The Drupal pages included just a small PHP function specially written for this purpose which just fetched the content generated by the particular BOINC PHP file and presented it in Drupal. For BOINC administration pages, this function was BOINC_admin_redirect(); and for other pages BOINC_redirect();. To separate the BOINC pages in Drupal from other content for easier management, separate content types were created for both BOINC administration pages and regular BOINC pages. The layout and styling of BOINC and Drupal content were made identical by editing the CSS files of both systems to match each other.

This method caused some problems. To generate pages for browsing user profiles either by name, or by letter, BOINC has a script that goes through its user database and creates static html pages accordingly. Because of this, it was necessary to create redirecting pages in Drupal for each country users are from, and each letter of the Alphabet, just to make the user browsing functionality in BOINC to work.

7.3 RSS feeds and events

It was thought as important for Renderfarm.fi to have some sort of connection to the online Blender community already existing. An RSS aggregator was added as a block on the front page of Renderfarm.fi, showing the latest news items from Blendernation.org, another community website. This way, users can get the latest information about everything Blender related from a site that is frequently visited by the Renderfarm.fi target audience.

One of the functions initially thought necessary was the ability to create events. By using the Events module this could be achieved, providing different events with a date or possibly a span of several dates, possibility for subscription, and a calendar for viewing all the events within the next month. A list of upcoming events was added as a block on the right sidebar.

7.4 Security

Additional security was thought necessary for site administration. Secure pages module was used for enabling SSL whenever administration pages are accessed, or content is created or edited. The web server was also configured to allow the usage of SSL for Drupal.

7.5 Newsletters

One way of keeping users up to date with current events on a website is allowing subscription to Newsletters. These letters should be content-filled and shouldn't be sent too frequently to avoid them being considered as spam. In order to attract new subscribers, the whole subscription, and removing a subscription should be as simple as possible. Also, newsletters work as a reminder to users who might have forgotten that they have created an account for the website. (O'Keefe 2008, 230.)

Newsletter functionality was implemented to the website by using the Simplenews module to allow easy subscription, and sending of these letters by E-mail. Further functionality can be added by modules allowing better formatting of the actual Newsletters themselves. Currently no possibility for subscription exists, but as the site opens to public, newsletters could be considered to be used for informing users about site news.

7.6 Visual design

The visual theme of the site was chosen to be based on a GPL licensed Drupal theming template, which was modified to better suit the needs of the project. Artists created logos and artwork to give the appearance a more personalized feel. Figure 7 gives a picture of how the site looks for users that are logged in. The front page for users not registered was given special attention as this page is the first thing visitors see, and formulate their initial assessment of the site based on it. It was thought that the front page should make three activities as simple as possible: Participation, acquisition of more information, and user login. This was done by creating a custom front page using the front page module. The content was written directly in PHP, HTML and CSS to achieve maximum control.

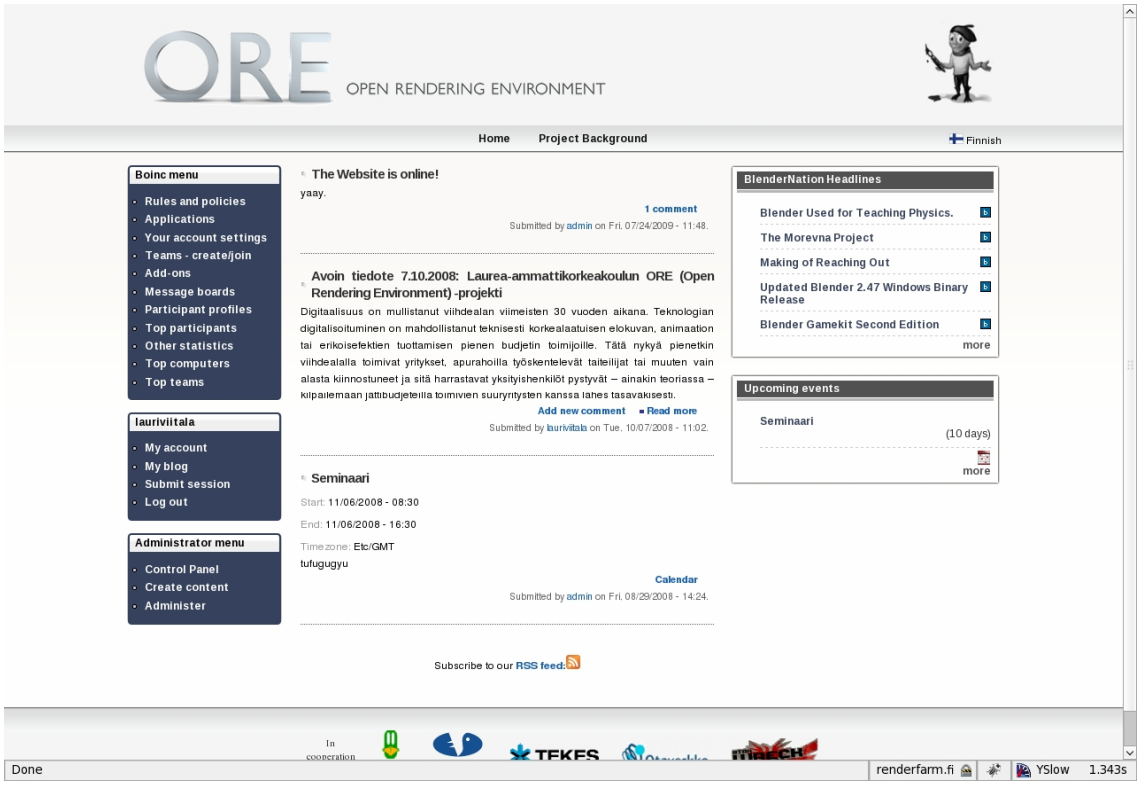

Figure 7: Screenshot of Renderfarm.fi beta, fall 2008

7.7 The Renderfarm.fi wiki

Initially it was planned to use a separate wiki platform in addition to Drupal and BOINC. This was because it wasn't believed at that point that Drupal could provide the required functionality for a wiki, and Renderfarm.fi would be better off with a dedicated platform for this purpose. It was recognized that adding a third system would create additional problems with logging in and user account authentication, as well as more work for site administrators. One of the options was Mediawiki, the software package originally written for Wikipedia. The upside of this solution would have been the familiarity of the interface and the whole system to users, as Wikipedia is by far the most popular wiki currently on the web. Also, Mediawiki has an extension for allowing usage of the Drupal database for user authentication, making it easier for users to switch between the systems, and not needing to log in separately for the wiki. Other wiki platforms such as TikiWiki were also considered, but they didn't seem to offer enough after Drupal's wiki capabilities were discovered to suit the needs of the site better than a separate bulky system. The idea of using a separate wiki platform was later abandoned, because it would have required additional work to bring in a third system, and it would be hard to make it visually similar to the other parts of the site created by Drupal theming.

The Renderfarm.fi wiki currently has a small collection of Blender tutorials to help new comers learn the basics of rendering. This could be expanded to a comprehensive guide for using Blender to create 3D animations. Registered users would be able to add their own Video tutorials in addition to Commenting and improving existing ones. The creation of this wiki would greatly support the whole Renderfarm.fi service by providing beginners an readily available source of information for using Blender and therefore start using and contributing to the most important aspect of ORE: the publicly distributed rendering.

The Renderfarm.fi wiki has been implemented by using the book module as a base. This provides the necessary hierarchical structure, with additional functionality brought from other modules. The Diff module allows easy viewing of revisions and Talk puts all the comments on a separate discussion page. This was done to make the Renderfarm.fi wiki more like Wikipedia, which is well known and similar functionality would cause users less trouble using it. Wikipedia also uses a set of formating rules for things such as headings and internal links. This same Mediawiki formatting that is used in Wikipedia, was implemented using the PEAR wikifilter module. Originally also a short quiz was planned to be added at the end of every tutorial, but this was thought to be unnecessary, only making the tutorials feel more exam-like.

7.8 Performance

The performance of Renderfarm.fi was tested by using a Firefox add-on called YSlow integrated with Firebug. YSlow is used for analyzing the performance of websites based on best practices for high performance web sites, created by the Yahoo!'s Exceptional performance team. YSlow generates a grade for different rules and an overall grade. It should be noted that at the time of testing, Renderfarm.fi didn't have page caching turned on for the sake of making site development more convenient. This way the server returns a fresh copy of newly updated content instead of trying to retrieve the content from cache.

For comparison, the BURP website (http://burp.BOINC.dk) was also tested for performance with YSlow and got rated D as an overall grade, while the Renderfarm.fi frontpage was rated as an F. The YSlow test result for rendefarm.fi can be seen from Figure 8 and the results for burp.boinc.dk from Figure 9. The best practices that Renderfarm.fi complied to with the least extent were:

- Making fewer HTTP requests
- Using a CDN
- Adding expires headers
- Gzipping components
- Configuring Etags

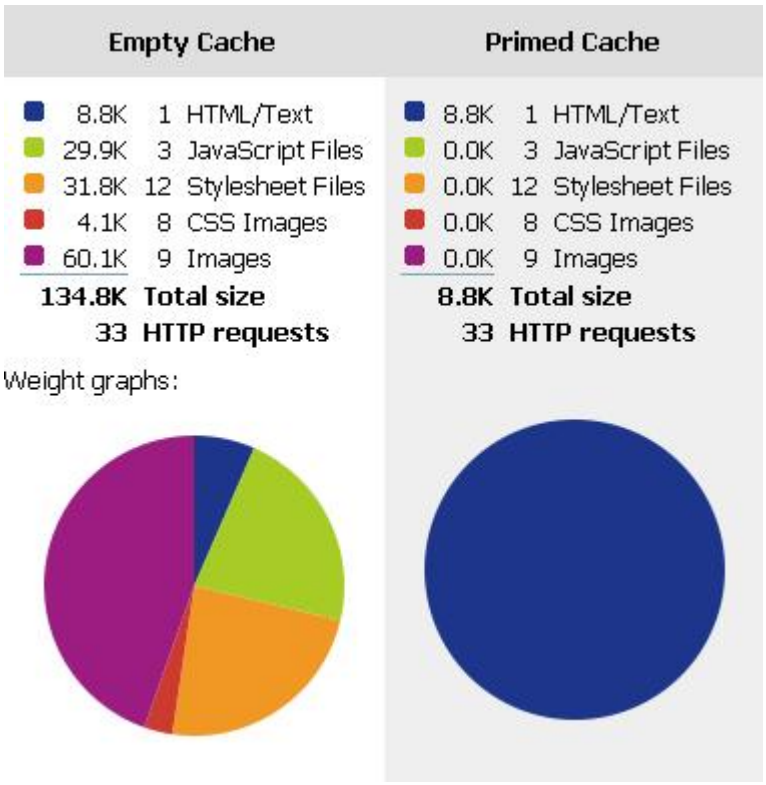

Figure 8: The weight of Renderfarm.fi front page with empty and primed cache on 19.01.2008

The overall performance of the site was found to be lower than BOINC sites working without a CMS. However, it is worth noting that performance hasn't been given any attention at this point of site development, as the focus has been on making all the features function correctly. At the time of testing Gzipping components has been disabled from Drupal intentionally for development reasons, so the biggest performance issue compared with other BOINC sites is the amount of HTTP requests Drupal makes, because of CSS being broken down to several different files in different modules. This could be reduced by combining CSS files together. The weight of the Renderfarm.fi front page with no cached content was substantially bigger than the weight of the BURP front page. This was mainly due to larger images, CSS files and JavaScript Files. Fetching pages from BOINC with the BOINC_redirect(); funtion didn't seem to have an impact on performance.

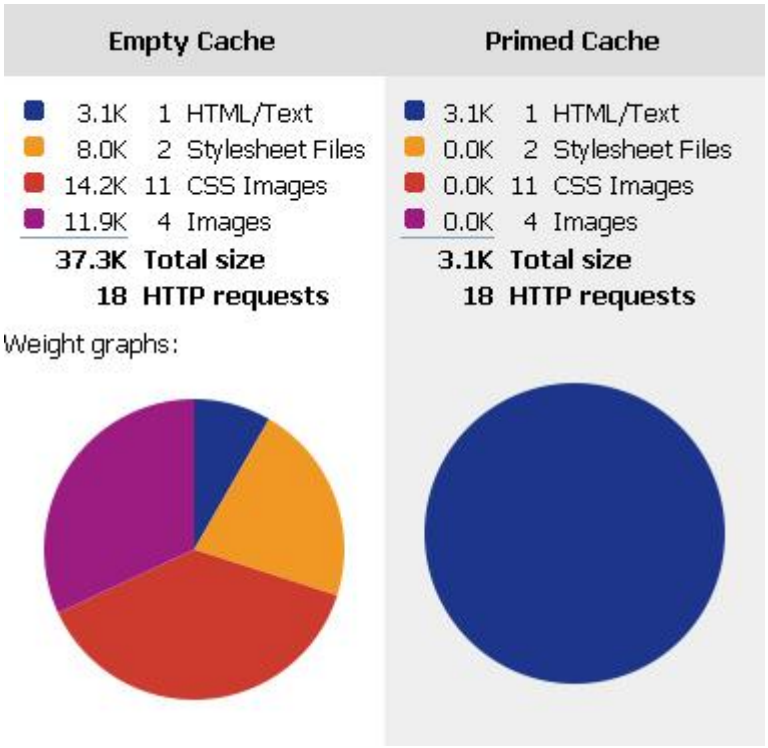

Figure 9: The weight of BURP frontpage (http://burp.BOINC.dk) with empty and primed cache on 19.01.2008

7.9 Site development issues

One of the issues concerning site development was web browser compatibility. From the get-go it was thought that the web site should work properly also with Opera and other browsers using the Webkit framework for rendering web pages, in addition to Mozilla Firefox and Microsoft Internet Explorer. This demanded additional work with the CSS-styling provided by the Drupal theme. Additional CSS editing was made for the front page to appear correctly, and attention was put into ensuring that the CSS interpretation of Internet Explorer visualized the pages correctly.

Content and interface translation required attention as the BOINC supplied part of the web site didn't have translations available for Finnish, the second language intended to be used for Renderfarm.fi. This translation was done by editing the translation files which can be downloaded from the BOINC website. Drupal had Finnish translation files available for the interface, but most of the additional modules needed to be translated manually. The most convenient way was found to be changing the site language to Finnish, and searching individual words not correctly translated and using the string management functionality

provided by the Locale module to create the correct translations. Content translation proved to require more work, as Finnish versions of all the content needed to be created.

7.10 ORE from a company perspective

In 19.2.09 an interview was conducted with Janne Juopperi from the company 3D-Verstas. This Finnish company is specialized in the production of 3D-animations, special effects, and modeling for the use of TV-commercials and product manuals for example. The primary tool used in 3D-Verstas for creating these productions is Blender, and the company is working in cooperation with Open Rendering Environment. The interview was done in Finnish for the sake on convenience, and focuses on the community aspects of ORE, and their possible benefits for companies.

The main expectation of Juopperi regarding ORE was found to be the increase of rendering capacity that ORE is able to provide. The ability to choose different licensing options from a menu was mentioned to be useful, but additional descriptions of the content of these licenses would be needed. From a company perspective, the ability to be aware who and which computers are able to see the renders would be appreciated. The finalized renders would be nice to have also in an un-compressed format such as OpenEXR. Further improvement in the user interface of the website was also regarded as being important, learning from examples set by similar commercial services.

Juopperi mentioned that the development of the community aspects of ORE is one of the most significant ways of increasing the use of Open Source software such as Blender, in companies as well as individuals. This can be achieved especially by creating a community around the usage of the software, not only for the development. However, a company using Open Source software can have a negative impact on it's image because of the common attitude that quality animations can only be produced with commercial software such as 3ds Max. The acceptance of using software such as Blender is bound to increase though, because of rapid development cycles typical to Open Source, further increased by communal activity.

According to Juopperi, for companies the collaborative functionality and ability to exchange ideas can result in better end products and therefore be beneficial to business. Also, community and collaboration can provide the means for a more scalable workforce, facilitating the search for potential and competent manpower.

Even though Juopperi stated that while the Render jobs being visible to the public is not a problem to 3D-verstas, their customers might disagree with this, as they are under a non-

disclosure obligation. In some cases however, the customer might feel that free publicity in the production phase could be beneficial to them.

8 Adding value with Drupal

In addition to just being considered as a content management system, Drupal is also a content management framework. This emphasizes the ability to customize and configure extensively through modularity to suit the needs of the user. Drupal tries to balance abstraction with specific functionality by providing readily available components that can be used out of the box, or if needed, can be configured by a wide range of options. This principle of manageable abstraction was the most important reason for choosing Drupal to be used in ORE. As site development has been going on for nearly a year, it has proven to be a good choice as it leaves all doors open for extensibility. This has been very important as the possibilities of Drupal were not fully understood when the project was started, and plans for the web site and its functionality have evolved with time.
(The Drupal overview 2009)

This section describes further possibilities in Drupal for molding Renderfarm.fi into a more user-centered community site. Making benefit of groundswell technologies described in section 5 and ideas presented by Christodoulu and Styliaras in their paper "Art meets Web 2.0 trend" are the focus of this section. The Interview of Janne Juopperi from 3D-verstas examined earlier is also taken into account when considering improvements and further functionality to increase the value of ORE to companies. All of the possibilities described below can be implemented by using Drupal modules. Information about how the modules work has been acquired from the Documentation on the Drupal website. These modules can be easily added, tested, and removed if proven not feasible. All of this can be done by a site administrator with access to the Drupal module directory, where the modules can be stored, and then activated from within Drupal. One way of testing the popularity of these features is to allow users to decide by creating a poll with one of Drupal's core modules. Users could vote for which features they want to keep and which are unnecessary. These additions would contribute to the creation of a community site with the following functionality:

- newcomers can access a resource for learning and also learn from more established artists
- a community to bring together artists and start projects
- a community that encourages relationships between users
- tools to support collaboration among artists and projects
- source for computing power to render these projects

8.1 Customizing content display

One possibility for RSS aggregators could be the ability to subscribe to another user's feed. If a user is interested in someone else's work in particular, he could stay informed about his work, newly created blog entries, and other content that he has created by the means of a web feed. (Christodoulou & Styliaras 2008, 4.)

In addition to the RSS aggregator, other kinds of content feeds could be used for displaying what is new within Renderfarm.fi. For content types, this can be easily done by enabling blocks from the corresponding modules creating the information the feed is intended to display. For example, recent blog entries from all users or only selected ones could be displayed for everyone to view.

More customized ways of displaying content on a Drupal site is achieved by using views, which is a module that creates custom queries from the Drupal database. This allows content to be displayed and organized in different ways. Any nodes can be organized by date of creation, author, or in similar fashion. This can be used for example for collecting the latest render sessions together in a block, however this would require some coding as the images would need to be fetched from the session gallery which is a part of the BURP system, and each image is currently not a separate Drupal node. This could be even added to the front page for users that are not logged in, to add more visual appeal and give new comers a taste of the content that is created at Renderfarm.fi.

Views can be used together with taxonomy, which allows organizing content in vocabularies. These vocabularies contain one or more terms, which can be further organized hierarchically. Vocabularies can be predefined, where users select the one most suitable from a list made by site administrators, or alternatively users can create freely their own terms, called free tagging.

Content Construction Kit, or shortly CCK, is a module that allows the creation of custom content types. Out of the Box, Drupal has predefined content types such as news and a blog. More content types will be available when additional modules are installed. Content Construction Kit can be used to create specialized content types with custom fields to suit the needs of the web site. The fields can include text, images, videos and more complex functionality that can be added as separate modules. CCK content types, like any other content types, can be displayed in various ways with views. A custom content type could be created for animations, with data filled in from BURP. In addition, a second custom content type could be created for animations created by companies, to allow them to customize how

much they want publicity for the animation, preventing any possible breaches of non-disclosure obligations.

8.2 Tagging and rating content

Tagadelic is the Drupal module for creating tag clouds, by altering font sizes on the tag to reflect popularity. Tags are fetched from taxonomy terms and vocabularies. The functionality of Tagadelic can be further expanded by adding separate modules to add views integration and the ability for users to tag content made by others with the community tags module.

Drupal enables content rating by a number of modules. Fivestar is a simple widget that allows rating on nodes, by allowing users to give any number of stars out of five to a piece of content, and also showing the average of all ratings on the node. Fivestar benefits from AJAX and requires no page refreshing. The module includes a Fivestar CCK field that can be used when creating the custom content type for animations. This makes users react to each other by rating the work of others. Views can be used to create a hall of fame to display the animations with the best average ratings. Further possibilities can be implemented by the Affinity module, which is used to match users with others based on their voting behavior that they have exercised using the Fivestar module among others. This way, users with similar tastes can discover each other.

8.3 Social Networking features

Currently Renderfarm.fi has profiles where users can write short descriptions about themselves and their interests, and add a proflile picture. This functionality is built in the BOINC supplied part of the web site, and also includes the ability to add other users as Friends.

User relationships is a Drupal module that makes users aware of each other. Different types of relationships can be defined by site administrators, allowing the creation of “friending” system. Other kind of relationships can be created also, as they can be one sided or mutual. Also the need of approval by the can be configured. Private messaging can be integrated with this system by adding an add-on module.

8.4 Private messaging and communicating with other users

E-mail is the traditional way of communicating one-to-one on the internet, and in the case of Renderfarm.fi, user e-mail addresses can be obtained from their profiles. Also forum private

messaging is another way to make this possible. However this kind of communication is slow and messages have to be checked frequently.

The site interface has a list of online users always visible on the left sidebar. However it can become frustrating that there is no means for reaching out to them in real time. The interface could be upgraded to include private messaging capabilities. Example set by Facebook's chat application, similar to desktop instant messengers, could be followed. This could just be a small chat box within a block on the webpage. Drupal has several modules available to achieve this, and it would give immediacy to communications between users and could benefit the site. Also the response time of site administrators in case of problems or questions would decrease as they could be contacted immediately if they are online.

Also having a shoutbox or a chatroom system similar to the DeviantArt messaging network in could be considered. User created chatrooms would however require a substantial amount of users online at the same time to be sensible.

8.5 Organic groups and collaborative environments

With Drupal, users can be allowed to create and manage their own teams, called organic groups. These could be used for allowing users to create their own team pages for their BOINC teams, with their own news items and content, even their own visual theme. However integration with the BOINC team system would first need to be implemented. These groups can be either freely joinable by any other user, or they can be invitation only if required. A community site like Renderfarm.fi can bring together like-minded users so they can share ideas and learn from each other. This sort of functionality could also be used as a catalyst for artistic collaboration within Renderfarm.fi for sharing ideas and managing projects.

8.6 Wiki capabilities

Drupal can be changed into a wiki platform by installing a collection of modules that enable wiki-like behavior. Also the Wiki should include all the instructions and guidelines for using the site. The current implementation has all the core functionality that a wiki needs, but can be further improved. Interwiki linking would we possible to enable easy access to existing resources of Blender knowledge such as wiki.blender.org. Also, if at some point, the wiki grows so much that content management becomes difficult, it might be worth considering exporting all the content, and moving it to use a dedicated wiki platform such as Mediawiki, which is proven to be able to handle huge amounts of content. Drupal has modules for data exportation from nodes, but it remains unclear are they suitable for this job, and would it be necessary to manually add each page separately to the new wiki.

8.7 Managing large file uploads and downloads

Open Rendering Environment currently has all rendered animations available for download as both streamable and high quality MPEG 4 video files. As animations get longer, the file sizes of the high quality videos can become large. In the future as the number of users grow, and therefore the number of downloads increase, this can become a potential problem regarding available bandwidth.

For large files an option could be to use the bittorrent protocol. Bittorrent is the most popular peer-to-peer file transfer protocol on the internet, which can be used for large files, as each peer downloading the file also uploads it to other peers. The bittorrent module available for Drupal allows the managing of torrents on a Drupal site. The Web seed extension also allows the server to act as a seed when there are no other seeds, making the files always available. The server would also act as a tracker, with possible upload ratios to forbid leeching. If needed, the tracker could also use a passkey to allow only authenticated users to use it.

8.8 Ajax Widgets

Ajax is short for Asynchronous Java script and XML, a web development technique that enables web applications to have similar rich functionality that normally desktop applications only have. Ajax applications can retrieve and load data without requiring the refreshing of the web page, creating dynamic content and a lot of possibilities for interactivity. This decreases user delay, and also reduces the need for bandwidth when loading web pages, as the whole page doesn't need to be refreshed. The Downsides of Ajax are the inability to connect with the web browsers history, and it's reliance of JavaScript can cause problems with some search engines.

Ajax can be used in many ways to enhance the user experience of a community site using Drupal. The Ajax module enables Ajax forms in Drupal, allowing previewing and submitting forms without refreshing the page. This can be helpful for administrators when creating new content. One way of boosting participation on a website is content rating. In Renderfarm.fi, this could be done by allowing users to rate the renders of other users, and comment on them.

8.9 Simile Timeline

One Ajax widget has already been tried out with the website. This was a Timeline created by the Simile Project (http://simile.mit.edu/timeline/), used for presenting render sessions and the amount of time they had taken. When an event is clicked, a small box pops up with information about the render session and a screenshot. The timeline was populated with data from the BURP session XML file. The Date and time information on the XML file generated by BURP needed to be slightly changed so the timeline would present it correctly. However, when the timeline became populated with more and more events, the scrolling speed became very slow, and the idea was abandoned. It is possible that later something similar with better performance will be implemented, but this timeline is not a critical feature to be available at the time of launching the site to the public.

8.10 Gmaps

Using geographic information with the Google Maps API was briefly tested at an early stage of site development. Drupal has a Gmaps module available that works as an interface to the Google Maps API. Separate nodes in Drupal can be given location information, so things such as news items can be given the appropriate latitude and longitude values corresponding for example to the geographical location the news item is about. Users are provided a map on their profile page, where they can enter their geographical location.

This could be used for example by putting a small world map on a comments page displaying small markers on each of the commenting user's location. On team pages a map could show where all the members are from. Another possible implementation of Gmaps is to visualize the distribution of computing power to Renderfarm.fi by each country. Even render sessions could have the same location as the users who submitted them, visualized on a map on the session gallery page.

9 Conclusions

The focus of this thesis was studying the use of a content management system to create additional value to a BOINC project. The BOINC project in question is Open Rendering Environment, a volunteer computing project that takes advantage of both BOINC and BURP technologies to manage publicly distributed rendering. Instead of relying on the website template that is provided by BOINC, a decision was made to use the Drupal content management system to enable the use of web 2.0 technologies to create a BOINC project geared more towards a community site that meets the challenges of the modern dynamic web. The possible uses of groundswell technologies for creating web communities focusing on

art have been investigated. Furthermore, using Drupal as a groundswell platform to enable the use of these technologies has been examined.

9.1 The groundswell technology test

When evaluating a new technology in terms of the groundswell, Li and Bernoff give guidelines for what they call "The groundswell technology test". With five questions it tests the ideas behind the technology and how well it can enable relationships – the real focus of the groundswell. Taking in consideration the opportunities for further development, here Open Rendering Environment is tested for how well it complies with the principles of the groundswell.

Does it enable people to connect with each other in new ways?

Open Rendering Environment reaches out mainly to two different audiences: the BOINC users and Blender artists. BOINC users are mainly volunteer computing enthusiasts, willing to participate in new BOINC projects. Some of the BOINC users are already members in the beta phase due to invitations, and are familiar of the technology behind ORE from previous experiences with BURP.

BOINC projects alone have potential for creating relationships, by using the functionality built within the BOINC supplied website. Message boards, teams, and a friend system are all working out of the box when a new BOINC website is set up. However, with Drupal it's easier to make use of groundswell technologies, thanks to Drupal's modularity. Using these technologies can be beneficial especially when reaching out to audiences unaware of BOINC, such as artists. Blender artists already have several community sites available such as Blendernation.com, and Open Rendering Environment is not the first BOINC project, and not even the first public distributed rendering project. It is however the first volunteer computing project that tries to reach out to a larger audience than people merely interested in scientific computing. It could build a community around this source for computing power to help the work of artists and companies. It could help users to promote their work. It could reach out to aspiring 3D-artists with access to a resource for learning and also learn from more established artists. It could provide tools to support collaboration among artists and projects.

Is it effortless to sign up for?

Participating in Open Rendering Environment is simple. When the site opens for public it will have free registration, and no periodic subscription fees. In addition to this, the user needs to download the BOINC client software and use it to join the correct BOINC project. The client is open source software, and thus available for download without cost. Blender too is open source and users can download it without charge and start learning with onsite tutorials. When users don't have to spend any money to get started, giving the service a chance becomes a lot more compelling.

To make Renderfarm.fi even more accessible, a Blender script has been written to allow users to upload their animations directly from Blender. Open Rendering Environment Uploader is a Blender script that works as a simple submission form integrated to Blender, meaning that users don't have to submit their animations on the website, making the use of Renderfarm.fi even more effortless. The uploader has been released as a beta (see Figure 10), but later a fully functional version will be available.

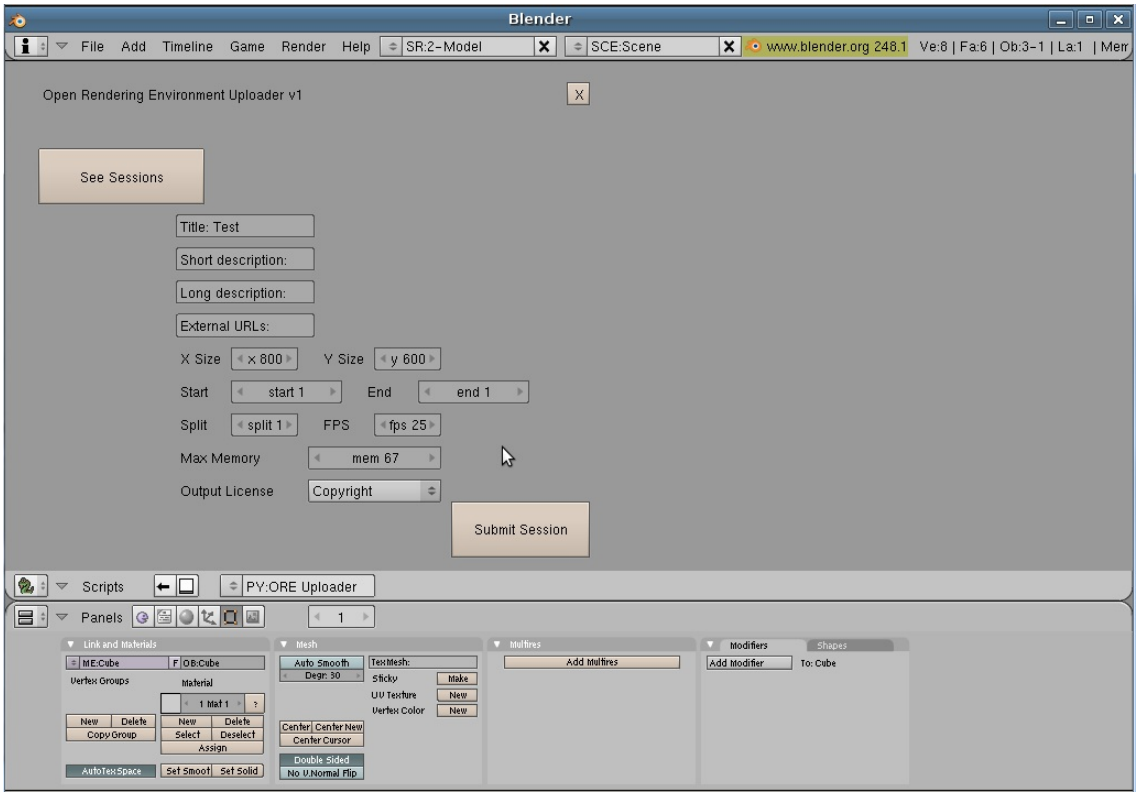

Figure 10: Screenshot of ORE Uploader script beta version

Does it shift power from institutions to people?

The very nature of volunteer computing shifts power from institutions to people. When individuals who own the computers choose which projects they want to contribute to, government funding agencies will control resource allocation of science projects to a lesser extent (Anderson 2003, 6).

Computing power required to create high quality rendering has traditionally been a privilege of companies and movie studios, not individuals. Sure people could render the works on their personal computers, but a single scene could take weeks or months. Commercial render farms are available but volunteer computing is the first solution to provide the necessary processing power without having to pay anything. This, combined to the use of open source software alone, makes Open Rendering Environment a prime example of shifting power from institutions to people. It's all about providing resources that were available only to corporations before, and doing this by relying on software that is developed as community effort.

Does the community generate enough content to sustain itself?

The potential audience of Renderfarm.fi could create a self-sustaining community, as both BOINC and Blender have become popular. The amount of computing power available would dictate the amount of fresh animations available to see daily. Adding Drupal modules can expand the means to have an active community, and provide more opportunities for users to create content, such as writing tutorials, discussing on forums, write blogs, commenting on work and rating. As possibilities to interact are added, also the content created should increase accordingly.

Is it an open platform that invites partnerships?

It is important to note that all the technologies behind ORE are open source. The very nature of open source invites partnerships. Drupal makes benefit of user created modules. It allows the functionality of Renderfarm.fi to be extended, and users who are adept coders could help build custom modules if no existing ones provide functionality that is desired. Blender, Drupal and BOINC are mostly developed by volunteers, and anyone with adequate skills can participate in their development.

9.2 General conclusions

As the current implementation of Rendefarm.fi doesn't take the full advantage of what Drupal can offer, the possibilities for extensibility through modularity will prove to be valuable. The ability to publish Blogs, display RSS aggregators and other functionality add possibilities for users to interact with each other. Features can be easily added when they are needed, and removed when they prove to unnecessary. All modules won't suit the needs of every BOINC project, but the modularity lets different projects choose different modules to customize the site to suit their needs.

Drupal especially helps to take advantage of Groundswell technologies. Drupal enables other kinds of content to be created for the community to consume than just images and videos of renders. User profiles and some possibilities already exist in BOINC, but more social networking applications would be easy to implement. Ajax can be used to make a richer user experience. Rating individual renders would make users react to each other. When enough content is submitted, even organizing content by tagging would become feasible. User collaboration could result in a helpful wiki. The tools for creating all of these improvements are in Drupal.

Using Drupal with BOINC doesn't come without problems. Drupal can add flavour and functionality to a BOINC site, but in the end, the structure of the BOINC made web site remains there, because the content of the BOINC pages are fetched to Drupal and then displayed to the user. The BOINC pages are not all very user-friendly, and often contain a lot of text and information. Interaction with other users is currently not very convenient.

One improvement would be to do all user management within Drupal. As much functionality as possible currently done by BOINC should be handled by Drupal. Possibilities for writing Drupal modules that integrate the BOINC system better with Drupal should be considered, Instead of using the current functions to just display BOINC generated data within Drupal.

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Table of Figures

Appendix

Attachment 1 Janne Juopperin haastattelu 17.2.09

Kysymykset koskevat Open Rendering Environment palvelun verkkosivujen (www.renderfarm.fi) kehittämistä, hyödyntäen "web 2.0" henkisiä yhteisöllisiä ominaisuuksia Drupal-sisällönhallintajärjestelmän avulla.

1. Yrityksen näkökulmasta, mitä ominaisuuksia 3d-verstas odottaa ORE:lta? Onko jotkut verkkosivujen nykyisistä ominaisuuksista erityisen hyödyllisiä, ja mitä pitäisi lisätä?

Odotamme erityisesti 3D-animaatioiden renderöintikapasiteetin kasvua. Hyödyllinen ominaisuus on se, että renderöitävän projektin lisenssiasiat on hoidettu valikoiden avulla mallikkaasti. Lisäominaisuutena toivoisimme jonkinlaisia tarkennuksia siihen, mitä eri lisenssivaihtoehdot ihan konkretian tasolla voisivat esimerkiksi merkitä. Toivoisin myös jonkinlaisia tarkennuksia siihen, missä koneissa & kenen nähtävillä projekteja ihan konkreettisesti rendaillaan. Renderöinti lopputulos pitäisi saada ulos jossain ”pakkaamattomassa” muodossa (OpenEXR ?)...nyt ei vissiin vielä saa...?

2. Onko 3d-verstas kiinnostunut ORE:n tarjoaman laskentatehon lisäksi sen yhteisöllisistä ominaisuuksista, vaikka muiden käyttäjien kommenttien ja palautteen, tai yrityskohtaisen profiilisivun, blogin ja kuvapankin muodossa?

Kyllä! Koemme, että nimenomaan yhteisöllisen toiminnan kehittäminen on eräs merkittävimmistä niistä keinoista, millä Blender eli ns. Open Source ohjelmien käyttöä voidaan edistää siten, että se hyödyttää niin ohjelman kehitystä, kuin myös itse käyttäjiä / yrityskäyttäjiä. Yhteisöllistä toimintaa siis itse ohjelmakehityksen lisäksi myös ohjelman käytön (sisällöntuotannon) puolelle

3. Voiko mielestäsi yhteisöllisiä ominaisuuksia hyödyntää yrityksen itsestään välittämän kuvan parantamisessa?

Kyllä, joskin tällä hetkellä Open Source ohjelmia hyödyntävän yrityksen imago voi olla myös negatiivinen, koska yleisesti vielä koetaan esimerkiksi, että ilman ”3dsMaxia ei voi tehdä laadukasta animaatiota”. Uskon kuitenkin, että tämä väärä asenne tulee pikku hiljaa muuttumaan, koska A) Open Source ohjelmat kehittyvät nopeammin suhteessa vastaaviin kaupallisiin ohjelmiin ja B) Nettiyhteisöllisyys aletaan kokea ”arvokkaaksi asiaksi” ihan jo arkipäiväisessäkin elämässä esim. FaceBookin ja YouTube:n yleistymisen myötä.

4. Jos ORE onnistuu saavuttamaan merkittävää suosiota 3d-artistien piireissä, voiko yrityksille olla hyötyä sen tarjoamasta "julkisuudesta" alan harrastajien, tai muiden yritysten keskuudessa?

Kyllä, viittaan edelliseen vastaukseen.

5. Voiko yritykselle olla hyötyä käyttäjien välisen yhteistyön mahdollistavista ominaisuuksista?

Kyllä. Mielipiteiden vaihto ja yhteistyö mahdollistaa aina ”parempia lopputuotteita” ja edesauttaa myös siis loppupeleissä yrityksen liiketaloudellista toimintaa. Yhteistyö / yhteisöllisyys mahdollistaa ehkä myös ns. ”skaalautuvamman tuotantokoneiston”, eli pienenkin yrityksen on helppo löytää nopeasti osaavaa työvoimaa.

6. Onko yrityksellä renderöintien julkisuuteen liittyen mitään mielipidettä, nythän valmiit työt ovat näkyvissä käyttäjille sessio galleriassa? Onko tärkeää tarjota mahdollisuus pitää yritysten työt muiden näkymättömissä?

Meitä ei haittaa, vaikka työ ovat ”julkisesti näkyvillä”, mutta meidän asiakkaat eivät välttämättä tähän suostu. Eli joitakin projekteja sitoo esim. patentteihin liittyvä vaitiolovelvollisuus, jonka takia tällaisissa tapauksissa ORE:n käyttämine ei tule kysymykseenkään. Toisaalta jossain tapauksissa asiakas voisi kokea saavansa ”ilmaista mainosta” kun heidän tuotettaan näytetään jo mainoksen tuotantovaiheessa eri ihmisille.

7. Tuleeko mieleen mitään muuta mitä pitäisi ottaa huomioon ORE:n verkkosivuja kehitettäessä, josta voisi olla yrityksille hyötyä?

Käyttöliittymää pitää tietenkin aktiivisesti koko ajan pyrkiä kehittämää, mihin kannattaa hakea vinkkiä esim. maksullisten renderöintipalvelujen käyttöliittymistä.