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e-ScienceTalk: Measuring the Impact of Online Outreach for e-Infrastructures

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Abstract: Over the last decade, the European Commission and governments have invested substantial funds in distributed computing infrastructures. e-ScienceTalk disseminates the success stories and impact of these e-infrastructures. Stories come from the flagship pan-European projects but also from a host of smaller and emerging projects. For e-ScienceTalk's first year, outputs and outcomes were recorded through a range of methods, including tracking output metrics and by monitoring online traffic. This information collectively provided evidence of the project's wide global reach. Generally, most of e-ScienceTalk's target metrics for the first 12 months have been met or exceeded. For the future, metrics will be added to measure impact and track website usage in a more representative way. Evaluation will continue to be important for developing a sustainability strategy for e-ScienceTalk products, as will working with other projects through collaboration agreements to maximise impact.

1. Introduction

On 4 July, scientists and journalists around the world listened in anticipation for the physics announcement of the decade: the discovery of a new particle consistent with theories of the Higgs boson. "It's been a global effort, a global success. It has only been possible because of the extraordinary achievements of the experiments, infrastructure and grid computing," said Rolf Heuer, Director General at CERN. Whether or not this discovery is the particle that represents the missing piece in the puzzle of the standard model remains to be seen, but the importance of distributed computing in processing the data that led to it is clear. The last 10 years have seen the European Commission and governments invest substantial funds in distributed computing infrastructures. Scientists have access to state-of-the-art computational and data resources located around the world, placing European research in a leading position to address the greatest challenges facing us today, such as climate change, pandemics and sustainable energy. The advent of the European Grid Infrastructure, combined with the blurring of boundaries between grids, clouds, supercomputing networks and volunteer grids means that a clear consistent source of information aimed at non-experts is now more important than ever, through communications projects that cross national boundaries.

e-ScienceTalk disseminates the success stories and impact of distributed computing and their underlying e-infrastructures. These stories come from the flagship pan-European projects but also from a whole host of smaller and emerging projects. By giving these projects access to e-ScienceTalk's wide variety of communications channels, including websites, blogs, social media sites, weekly publications, events, conference booths and printed materials, their results can be disseminated far more widely and to a greater range of audiences than would otherwise be possible. This audience reaches beyond Europe to the US, to Asia and to Latin America.

e-ScienceTalk[1] is co-funded by the European Commission and is a collaboration between the European Grid Infrastructure, Queen Mary University of London, Imperial College London, CERN, and design firm APO. e-ScienceTalk runs six websites and has around 3,000 followers on various social media channels. Every week, the International Science Grid This Week[2] (iSGTW) newsletter reaches more than 8,000 subscribers in 196 countries and territories, sharing the success stories of e-science and technology. The readership includes policymakers, and journalists as well as computer scientists and researchers.

e-ScienceCity[3] is an extensive online portal, designed as a city, which brings together websites on grid computing (the GridCafé)[4], cloud computing (the CloudLounge)[5] and volunteer computing (the Volunteer Garage)[6] as well as central areas for news, debate and discussion. GridGuide[7] shows the human face to grid computing via an interactive visual demonstration of the "who, what, where and why" of grid sites around the world. The Real Time Monitor[8] (RTM) shows traffic in real time on the grid and the GÉANT network. Breaking down the big issues in e-science, e-ScienceBriefings[9] provide a jargon-free look at some of the challenges and questions being addressed in the e-infrastructure policy arena and are distributed to policy makers across Europe.

2. Objectives

e-ScienceTalk's key aims are to work with the distributed computing infrastructures, and to maintain and enhance the quality of existing outputs, while reaching out to new disciplines and regions. Outlined below are some of the main objectives for the project:

To communicate the success stories and societal impact of grid computing, e-science and e-infrastructures to researchers throughout Europe and beyond.

1. To engage policy makers in grid and e-science.
2. To raise awareness amongst the general public of the existence of e-infrastructures and how these networks contribute to the online European Research Area and the Digital Agenda.
3. To communicate good practices and key successes to other projects.

A further objective for e-ScienceTalk is to assess the impact and outcomes of longer-running products, such as the GridCafé website, which has provided an introduction to grid computing since 2004 and the weekly e-science publication, International Science Grid This Week, which has been publishing for six years. This paper discusses the methodologies employed for assessing impact across blogs, videos, social media, websites, briefings and events, including social media impact measurement tools such as Klout.[10]

3. Methodology

The success of the e-ScienceTalk project in achieving its objectives and measuring its impact is assessed quantitatively by gathering metrics and web statistics, and qualitatively in the following ways:

1. Feedback sessions
2. Surveys
3. Feedback from expert advisory panels
4. Unsolicited feedback
5. Website statistics through Google analytics[11]
6. Commentary and interaction gathered from our social media outputs, as well as from social media measurement tools

The impacts of the outputs from e-ScienceTalk were evaluated and analysed using the above methods for an 18 month period, and the preliminary results are summarised below.

4. Technology Description

4.1 Feedback Sessions

e-ScienceTalk has a diverse audience including influential policymakers in government and business, scientists and the general public, and therefore requires an extensive and varied strategy for collecting feedback. The project routinely carries out formative and summative evaluations during both conception and development of its online services using a number of different technologies and methodologies. During the project's first year, one-to-one feedback sessions were organised with participants at several e-science and computing conferences. On an *ad-hoc* basis, additional informal anecdotal feedback from delegates was also recorded by e-ScienceTalk to help improve the individual resources. Towards the end of the first year, both science communication professionals and scientists from a variety of fields were asked to examine the different products on the e-ScienceTalk website and comment on the following parameters: interface and navigation, content and layout, and accessibility for the intended audiences.

4.2 Surveys

A survey of iSGTW's readership was conducted in July 2011 to give readers a chance to share their opinions on the online magazine's layout, navigation and content. Participants filled in a multiple choice survey and provided commentary in open-ended questioning using an online tool called Zoomerang.[11] For the last six years, iSGTW has conducted an annual survey of its subscribers to keep up-to-date with its readership's evolving interests, and to develop the scope of the publication.

4.3 Expert Advisory Panels

e-ScienceTalk consults with expert advisory boards, and the project team values their collective expertise in facilitating decision making on coverage of controversial or complex technical topics. An international advisory board (comprised of representatives of the funding partners with expertise in communications and management) oversees iSGTW. The Editor-in-Chief of iSGTW regularly liaises with the Advisory Board, which directs the content balance and mission for the publication. The online magazine is also previewed by the panel before the publication date. The e-ScienceBriefings policy advisory board includes policy experts from the e-Infrastructure Reflection Group,[12] and representatives of major e-infrastructures such as the European Grid Infrastructure and GÉANT.

4.4 Unsolicited Feedback

Throughout the project's first year, unsolicited feedback has been gathered from a variety of sources. This type of commentary provides meaningful examples of how individuals in the community are using e-ScienceTalk products and how each service is making a difference. For example, unsolicited emails or comments to the iSGTW editors can give an indication of how articles are perceived, and if any actions were taken as a result or knowledge gained (e.g. discovery of new products or tools). Feedback and insights have also been gleaned through regular monitoring of website comments, and recording both 'unsolicited praise' and 'constructive criticism' from email correspondence.

4.5 Website Analytics

Since September 2010, website traffic data has been closely monitored through Google Analytics for all websites within the e-ScienceTalk project (e.g. GridCast, GridCafé, e-ScienceCity, GridGuide, iSGTW). This open-source measurement tool provides a wealth of information, not just about reader numbers for individual pages but also the paths readers take through the website, geographical location, technical information, and many other metrics. Website statistics can also offer an insight into users' behaviour and therefore provides e-ScienceTalk with data for enhancing visitor experience and formulating marketing campaigns.

4.6 Social Media Measurement Tools

The global adoption of social media tools and platforms has increased dramatically over five years. Keeping up-to-date with this trend, e-ScienceTalk has grown its social media presence in the last year, which now has a wide reach as seen through Facebook Insights. Due to the fact that social media channels make direct engagement possible by users, feedback is inevitable and encouraged, and can be used as a basis for making improvements and for discovering users' preferences. A social network's true reach (numbers influenced) and amplification (a measure of your influence) can now be assessed by various algorithms using online tools such as Socialmention.com[13] and Klout.

5. Developments

For e-ScienceTalk's first year, outputs and outcomes were recorded through tracking various output metrics (e.g. circulation and production) and by monitoring online traffic (e.g. page views). This information collectively provided evidence for the project's wide global reach. At the end of year one, the project team modified the metrics and adapted the evaluation methodology to capture the significance of the project's outputs and outcomes, going beyond assessing whether the "aims of the project have been achieved," and committing to measuring longer-term impacts.

Since September 2011, a deeper analysis of content, mobile platform activity, conversions and social media was conducted using Google Analytics. The project has also integrated a comprehensive social media assessment into its evaluation strategy, measuring counts and analytics (e.g. sum of 'Friends', 'Followers', RSS feeds) in addition to social engagement and social actions. The goal is to assess how many people are actively participating, for example through comments on posts, uploads of pictures and videos. Integration of analytics from sharing platforms such as ShareThis and AddThis into Google Analytics has allowed the project to visualise the number and types of social actions (+1 clicks, Tweets, send, like, stumbleupon etc.) on specific social networks (Google, Facebook, Twitter, Digg etc.). The e-ScienceTalk social media ecosystem's influence is also tracked using multiple third-party Twitter tools (e.g. Tweetgrader[14] and Tweetreach[15]).

Analysis of the significance of e-ScienceTalk's outputs has been addressed through various case studies. Interviewing promoters and multipliers of e-ScienceTalk content can be illuminating and a valuable form of media analysis. Such exploration can reveal not only the path but the reasons for content re-use (e.g. re-tweeting) giving a further insight into which news elements or topics tend to spark further discussion. Regular Google alerts and monthly searches reveal whether iSGTW articles and GridCast content has been 'picked up' by the wider science and technology media. e-ScienceTalk has also adopted new visualisation techniques to illustrate the project's impact, such as videos, 'infographic' posters and photographs.

Before developing new content sections for e-ScienceCity, a formative evaluation is undertaken to understand and address the target communities' interests and needs. This is usually carried out through regular face-to-face and online focus groups. Furthermore, a post-development web-based survey is often used to evaluate the impact of the educational resource on its target audience (e.g. for each individual section of e-ScienceCity). For example, website visitors are requested to complete a thought-listing item exercise pre and post visit (e.g. Write down five words/phrases that come to mind when you think of 'Cloud Computing?). Word/phrase comparisons through coding analysis can gauge if any change in knowledge has taken place. Other methodologies to be implemented include a usability test to empirically evaluate the effectiveness of websites, to ensure delivery of relevant content in an intuitive way.

e-Sciencetalk supports a heterogeneous e-science community of researchers. To reach out to as wide a variety of researchers as possible, the project has formalised partnerships with several other FP7 funded e-infrastructure projects (EMI[16], EGI-InSPIRE[17], CHAIN[18] and WeNMR[19]) through a bilateral agreement between parties – a Memorandum of Understanding. On a bi-annual basis, e-ScienceTalk provides an audit to each organisation outlining how the project is meeting its obligations through its dissemination activities and an estimation of their reach.

6. Results

Feedback from one-to-one interviews from various e-science conferences attended by the e-ScienceTalk team indicates that e-ScienceBriefings are providing a useful information source for a range of different audiences including user communities, policy makers and network providers. Policy makers regard briefings as important in explaining or presenting aspects of e-infrastructure to funders, providers and policy people. Policy makers at the EGI-Technical Forum 2010 conference agreed that e-ScienceBriefings had increased their awareness of e-infrastructure, e-ScienceTalk and the aims of collaborating projects.

GridCafé has been an extremely successful venture within the e-ScienceTalk project. According to the web statistics it continues to be the second most referenced and visited e-ScienceTalk product after iSGTW (see Figure 1). With the website in Russian in progress and the website already available in Chinese, the global dissemination of the project has been extended to researchers in two of the world's emerging economies. Interviews indicate that the images and animations were well-designed and the layout was constructed in an intuitive way.

GridCast continues to develop and foster an active community and to develop thought-provoking comments to encourage and foster debate and commentary. Since its launch as a community-only targeted blog, longer, more serious editorial articles have been introduced to engage new members. Entries by expert bloggers have also been picked up by other media outlets such as HPC Wire[20].

The GridGuide map has been cited as a good way of demonstrating what the grid does, and provides a draw for people researching grids and e-infrastructure in their own locality. Feedback from users has been extremely positive, and Real Time Monitor demos have even been requested by regular users and endorsers of grid computing and EGI. Improvements in the functionality of the Real Time Monitor have increased the number of jobs that can be displayed. For example, jobs from the LHC experiment, ATLAS, are now displayed on the RTM in near real-time as a new layer.

iSGTW subscriptions have increased over the last few years (see Figure 2) but the magazine has also built a strong social media presence (see Figure 3). Feedback from iSGTW updates, emails and surveys has been continually collected in order to develop the iSGTW publication and website. Many of the science communicators and scientists, who gave their feedback in one-to-one interviews, commented on the excellent content and

layout. Layout is particularly important for focusing readers' attention and easing navigation. An iSGTW readership survey conducted in July 2011 gave readers a chance to share their opinions on iSGTW's layout, navigation and content. The survey's main focus was to gather feedback on the updated website, launched in January 2011 with enhanced Web 2.0 features and better interactivity. The survey showed that the profile of iSGTW readership has altered slightly with the newsletter attracting a more diverse range of professionals including more media specialists and journalists.

iSGTW is cited by various university departments, the US Library of Congress, and articles are regularly republished by science and technology magazines such as HPCwire, Wired[21], Cosmos[22] and other science blogs (Viz World[23]and Science Spring[24]). iSGTW articles have also been referenced by science writers.[25] e-ScienceTalk is also developing its social media presence, and has seen a rapid increase in Twitter follower numbers with a growing list of influential followers. According to Twiangulate[26] (a tool for mapping connections and measuring reach) @e_scitalk's 95 biggest followers have a combined reach of 1,600,000 (May 2012).

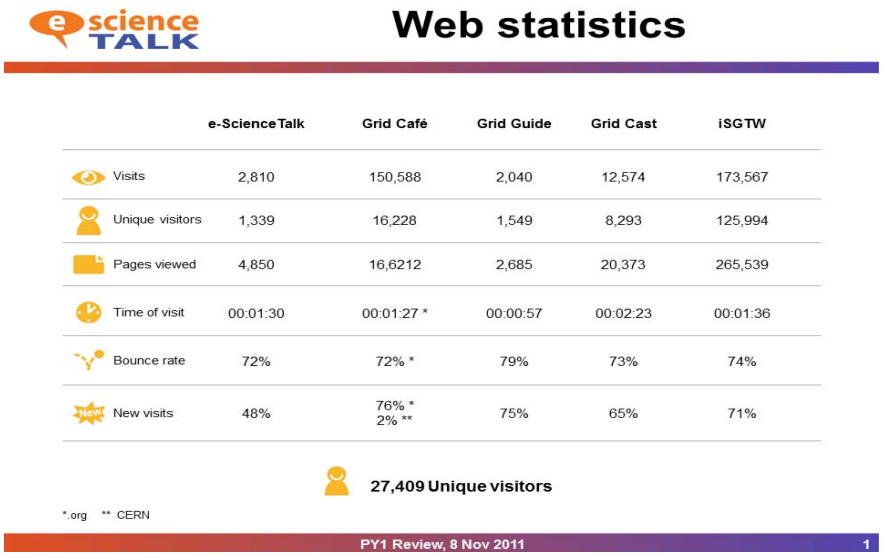

Figure1: shows the web statistics for Year 1

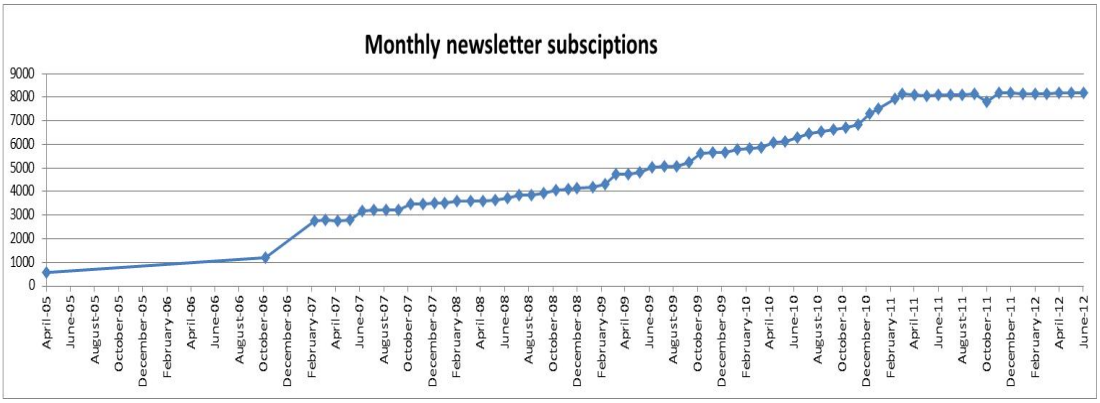

Figure 2: shows monthly newsletter subscribers to iSGTW

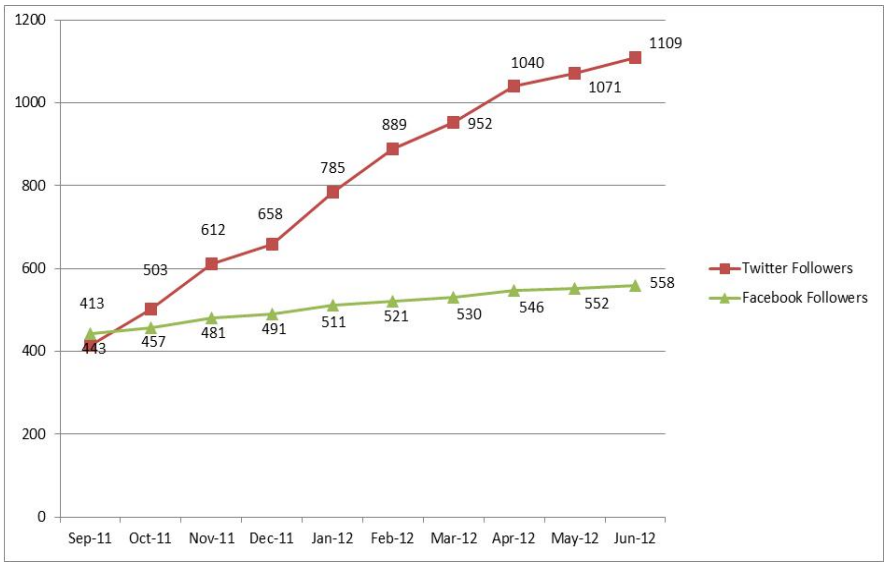

Figure 3: shows the number of Twitter and Facebook subscribers to iSGTW

7. Business Benefits

The next generation of European research will increasingly rely on collaboration across multiple disciplines and across national borders. The European Commission has unveiled Europe 2020 – a strategy to develop a smart, sustainable and inclusive economy based on innovation and knowledge transfer. The driving force behind this vision is the digital European Research Area (ERA).Creating a fully online ERA depends on developing e-Infrastructures that will enable the accomplishment of the 'fifth freedom' - free circulation of researchers, knowledge and technology across Europe. e-ScienceTalk's business benefit lies in sustaining activities that will promote the vision of Europe2020, and support the development of Europe's e-Infrastuctures.

The sustainability strategy focuses on evaluating all e-ScienceTalk products on their impact, maintenance overhead (costs/effort) and likelihood of attracting future funding or in□kind support. e-ScienceTalk has multiple stakeholders within the e-science and e-infrastructure field and disseminates the results of a host of FP7 funded projects. By monitoring the collaborative activities agreed within the project's higher level collaboration framework, its Memoranda of Understanding, a collective business case can be developed for the products and services that prove to be most valuable to the community. The project team therefore carefully markets, monitors and audits the impact of each individual activity, for all its MoU partners. The project will also produce an overview guide to dissemination for EC projects, based on the extensive experience gained and lessons learnt during all phases of the project.The term e-science is not widely known outside the community. e-ScienceTalk products have succeeded in increasing the visibility of e-science to its audiences, such as policy makers, the general public, journalists and scientist, succeeding in communicating research supported by distributed computing beyond the IT community. The project has enhanced the knowledge that current and future e-science researchers have of the infrastructure. Around 4,959 websites link to GridCafe, as it provides an easy introduction to grid computing. Over half of views last longer than thirty minutes indicating a highly engaged readership, and there is potential to develop this resource further for e-learning/multimedia. The project also brings increased impact for researchers' work. Videos can offer a visual and concise conceptual understanding of e-science research and there is a high price tag associated with successful video production and promotion. e-ScienceTalk provides these services as part of the project scope. The GridCast YouTube channel has in its lifetime attracted over 204,924 video views. Our online newsletter,

iSGTW, provides unbiased information on project know-how and successes, and evidence from readership surveys indicates that being published in the newsletter can directly help in fostering collaborations, and attract new users and funding. As well as providing a space for sharing scientific knowledge, the newsletter also offers areas for discussions that have assisted collaborations and spurred innovation. Fifty percent of those surveyed said they would recommend the newsletter to a colleague, and 21% have cited or linked an iSGTW article in a blog, paper, or talk. Analysis of RTM users has shown that numerous partners/institutions worldwide have it as permanent fixture in their institute or use it during tours for visitors or to showcase grid computing to potential funders.

While the short-term benefits of the project are more straightforward to articulate, directly assessing the longer-term business benefits is more challenging. The socio-economic value added by e-ScienceTalk is currently being evaluated externally by the ERINA+ project. Our users will have the opportunity to review our services. The need for dissemination is recognised by the European Commission for FP7 e-infrastructure projects, and is therefore a major part of the of the ERINA+ value chain[27]. The value chain describes how the success of any research project depends on its ability to communicate its results to its marketplace and clearly demonstrate how these results will benefit its end users. e-ScienceTalk provides a set of specialised communications consultancy services that can potentially benefit a range of stakeholders, including FP7 project coordinators, e-infrastructure providers, European Strategic Forum Research Infrastructure (ESFRI) projects and Research Infrastructures themselves. For example, the GridCast team provides professional multimedia support, while iSGTW's unbiased, non-technical and engaging style of reporting serves both individual projects in meeting their communication aims, but also raises the awareness of e-science (and of its important role in research) to those outside the community.

8. Conclusion

It is important to continue gathering feedback and recommendations from policy makers, journalists and delegates at conferences and to establish how the e-ScienceTalk products are used within the community. Understanding people's interests and their relationship to the project, recording observations from meetings, interviewing key informants, and in-depth analysis can help to measure policy influence and relationships, and the general impact on behaviour and opinions of e-ScienceTalk's activities.

Generally, most of e-ScienceTalk's target metrics for the first 18 months have been met or exceeded. The metrics used to track progress have themselves been analysed, with changes proposed for the following 18 months, such as introducing new metrics to measure the impact of e-ScienceTalk's attendance at events, including policy events, media partnerships and demonstrations. Metrics have also been added to track the usage of the websites in a more representative way i.e. length of time spent on the sites, percentage increases in unique visitors, new visitors and referrals to other sites. Both formative (e.g. focus groups) and summative evaluation have been carried out to examine the usefulness of e-ScienceTalk websites (i.e. changes in attitude or knowledge). Interaction with social media channels is also increasingly important for measuring impact (reach and significance), and a number of metrics have been added in this area, for example measuring interactivity and influence. We are also looking to improve the search engine optimisation for all the websites, for example by encouraging cross-links with other websites. This is one focus of the collaborations that we have established by signing MoUs with projects such as EMI, EGI-InSPIRE, CHAIN and WeNMR, among others. We will also compare eScienceTalk's approach to metrics and impact assessment with the recommendations to be made by eNventory and ERINA+ to refine our approaches for future years.

Our analysis and impact measurements show that e-ScienceTalk benefits its audiences by keeping them more up-to-date on new research/tools, by building a sense of community within the e-science arena, and by engaging policy makers in the possibilities that e-infrastructures offer for future progress towards the online ERA. The project uses existing channels where there are large potential audiences such as journalists and computer science/science enthusiasts (e.g. Twitter, Facebook) but has also created custom-built channels well tailored to particular audiences (e.g. the briefings for policy makers, iSGTW for scientists, the Real Time Monitor for grid users and the blog for e-science conference delegates). e-ScienceTalk is ultimately an innovative 'open science' vehicle which gives researchers the opportunity to share their methods, and their findings via blogs, social networking sites, the internet and video podcasts.

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