Early Exploration of Cloud Computing for Design Practice and Education

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Abstract: Cloud Computing, a phrase originally coined to represent telephony grids, is now used to generically describe service systems based on distributed computing of some description. In recent years Cloud Computing has gained substantial coverage, partially due to a flood of web-based services and to the move from hardware innovation to network and software innovation in some high tech industries. Although this situation has created the potential for a number of new forms of work practice, social behavior and collaboration, it has also led to a gap in working methodologies. Despite the fact that current research and popular practice have reacted to this shift, the implications to the Design Industry and to designers' practice has not yet been carefully examined. Additionally, as the shift is still underway, there is potential to make informed assessments relating to the expected outcome of this paradigm in the coming decade.

This paper will discuss the experiences of the authors in their journey into existing Cloud Computing technologies and services. The paper will discuss specific case studies and use archetypes of web-based services as a spring-board to speculate upon what design projects, studios, and design education may look like in a Cloud Computing scenario. Of particular interest is the discussion of how unexpected uses of tools and services would lead to unexpected use-cases, effecting the eventual workflow in design. Finally, we discuss some suggestions and interesting possibilities for the future of these technologies and tools in addition to lightly reviewing the implications of Cloud Computing related hardware on various aspects of design.

In conclusion, Cloud Computing and tools for its access have significant potential in providing new design methods as well as new ways of teaching and practicing in the design industry. This paper initiates discourse on this matter and shows evidence of related trends.

Key words: Design Tools, Design Education, New Media, Co-design/Co-creation/participatory design

1. Introduction

A dominating trend in information technology development of recent years has been the reliance on cloud mechanisms. These have included cloud based storage, such as Amazon's A3 service, cloud based identity management, such as OAuth and the Social Graph APIs from Google, cloud applications, and cloud development, as well as many other kinds of service structure [1,2,3]. Among them, however, they generally share the notion of tools and services which were in the past considered to be local, and are now being hosted on remote servers, and more often than not, on the servers of another company, whose particular location and specifications are not significant to the user. This powerful trend has had an impact on many aspects of the Internet, in cases like email moving from being a local application to a web based application and in more abstract shifts, from traditional social networks and clubs to the currently popular methods such as Cyworld, Twitter and Facebook. In the latter case, the impact has also been significant for life outside of the Internet, enabling different kinds of social formation, new structures of friendship and broad scale interaction. Implications beyond those to friendship also include whole industries changing to take advantage of faster, universally available communication and flexible software systems.

The world of design, also in a continuous state of change, has been impacted recently by a number of significant factors including the availability of design software such as CAD and image editing programs, and the growing presence of CNC, laser cutting and rapid prototyping. In particular, graphic design has seen a significant shift with the growth of digital media and the possibility of limitless near free publishing on the Internet. Industrial Design however, seems to be yet to be transformed by the Internet as such, except in that social media has brought about a new level of awareness of design in general. In other respects, Industrial Design, and most of the associated disciplines, such as Design Thinking, Strategy Design, Interior Design, Product Design etc. are predominantly still bound by many limits of the physical world. Though in some cases, changes have begun to occur, we still have wide opportunities to imagine the cloud enabled future of design. Integrating the elusive act of design with the high speed world of modern information can take many forms, depending on the level of abstraction, and the factors which can be considered relevant to these disciplines. How might design be if designers were connected to the world's information, not just what is around them and part of their physical life.

This paper sets out to give context to the state of the cloud, detail some examples of use in the form of case studies with relevance to design from the authors' experience in several cloud workflows, and discuss some aspects of the future of the designer in the cloud, raising arguments of experiential value and speculation of what the future might hold.

What the Cloud May Really Mean

It is difficult to neatly summarize the state of, and the potential of, cloud computing, however its implications on the world can be identified in a general sense. Cloud computing brings the possibility of removing wires, specific

computing hardware, and software from the computing experience by creating a platform where data need never be held locally, at the site of a computer or terminal, and where processing can be sourced from either other computers around the world or other humans interested in partaking [4]. This mechanism offers a new frontier of flexibility and makes streaming of any media, contributing ubiquitously to large collaborative projects and maintaining broad scale social connection with limitless numbers of people a regular possibility. Essentially speaking, Cloud computing has the potential to mask the back end of the computing and network experience from users and maximize technology accessibility as we know it. In some respects this is a next frontier of technology advancement however it's impact is more like a social shift.

Imagine a day when boredom is outmoded, because of the continuous availability of social contact and interesting information at our finger tips. In this world the way people interact will be different though even now a shift is starting to become evident. In this world standards can ensure rich quality of computing and interconnection, while the interaction, data mashups, and interfaces formed buy various services will be the determining factors in a services utility. In this way the abilities and facility provided by interactions with cloud data can be seen as an opportunity for competitiveness. With arbitrary, platform agnostic cloud connection we can expect that any device, will be a active participant, creating the possibility for cameras which upload images instantly and automatically, cars which read you your email, and phones on which you can manipulate large data sets easily, among numerous other possible uses. However, as well as not being local data does not need to be singularly personal and systems for sharing and collaborating richly are expected. One example of such a system in development is the Google Wave platform which hopes to introduce real time, as you type, interaction with large groups on a high speed, well managed and federated back end [5]. This is the future where distributed collaboration will become available to everyone and many factors of the world are likely to be impacted.

Some speculations of the cloud to come centre on the notion of Spimes, or an Internet of things which would include all the objects in our life [6]. From this perspective every aspect of our world is a likely provider or receiver of data, enabling the user to do things as simple as Google where they last placed their shoes, to finding details about the state of their possessions, how they are being used and how they are aging, as well as many other potentially interesting features. As we approach this context more and more objects are available which now have an internet presence including, WiFi cameras, WiFi music players, Stereos with ethernet, and even cars using realtime updated mapping data from Google Maps.

2. Method - The Cloud Project

The authors exploration of cloud computing is an ongoing project in two dimensions; one is a perspective of design education as studio based teaching and the other is a perspective of design practice. Earlier this year, 6 months ago, the authors decided upon a collaboration to develop an account of normal practice of using on-line computation resources in preference to software in their lap top computers. As for example this paper has been

written in Google docs as a collaboration between the authors located in South Korea and Australia respectively. The project uses the method of reflective practice to develop an understanding of the area - cloud computing - where the research is a form of action research.

Three key areas of practice were identified, these were communication, research and creative activities. In each of these areas the relevant on-line resources were identified and the desktop/laptop softwares were disabled. Both authors had access to relatively high speeds and unlimited access to the Internet. The work in Australia was in the context of design education and from the perspective of a design educator. The critical requirement was for the students doing the studio courses to use cloud computing too. This was effectively achieved as the students were in the research phase of their final year projects and had very little use of CAD software. The work in South Korea was from the context of a masters researcher working as a design practitioner collaborating richly on both private projects and those of his university, with people inside and outside of Korea. The cloud was relied on not only as the source of communication support but also a way to move and represent data diversely, learn of new possibilities, participate in both active and passive research, and integrate with a wide audience of potential collaborators who could offer context and suggestions on design work and who offered the opportunity for creative output to be responded to in a useful way almost immediately.

University Story

The university context of the project was undertaken at the Industrial Design Program at RMIT University. A group of 13 students of the 4th year were in the studio class where they were required to use a portfolio of resources. The semester was primarily a research semester with the design phase of their projects to be undertaken a semester later. However here a crucial character of the design studio at RMIT needs to be discussed. The dominant design culture privileges innovation and blue sky thinking in a strong context of sustainability theory. It is usual for the studio propositions to be about a future preferred reality where the design projects involve an element of the construction of scenarios for a future date, say 2030. This removes the possibility of incremental change and hence the need for the students to construct their projects with a justificatory framework where they have to tether their project rationale to the needs of contemporary society. In effect the research phase need not involve interviews and engagement with people at all. The specific regulatory legal framework in Australia also places a heavy burden of a regime of ethics upon the researcher, where for every bit of research involving people the appropriate approvals have to be sought. This has effectively changed design education where studios become propositional and abstracted from local contexts.

The majority of the research is in fact an immersion by the student in their area of project. The act of immersion required the student to become knowledgeable about their field of operation by looking at secondary resources – most of this material being available on-line. Within the ambit of the cloud computing project the students were required to set up a Firefox browser environment where they were to use add-ons such as scribefire (for annotat-

ing material for the Internet onto their blogs), vodpod (for posting audiovisual material from the Internet onto their blogs), and delicious (a bookmarking application for storing their links on-line). The on-line research documentation was to be done through a wordpress blog where the images and videos were to be stored in Picasa and youtube respectively. Additionally students were encouraged to use RSS feeds into Google reader and also use alerts for getting uptodate information using selected key words. The class tutorials had students presenting their work in progress through their blogs – and notes and sketches were also presented through the blogs.

Stage presentations required students to present a summary of work up to the relevant stage and this was done using Prezi(as an animated alternative to Power Point or other AV software). The students were also encouraged to begin the reflection and documentation of their projects from an early stage. In this case students made up PDFs of their document and uploaded it to Issuu and presented their work in class from these online sites.

In 2009 RMIT university required all staff to use Blackboard as a minimum online presence for each course taught in the university. The students resource documents were thus posted to the blackboard site and no hard copy documents were handed out to the students. Blackboard offered the option of conducting surveys, setting up group blogs and wikis for collaboration. The discussion board in blackboard was quite extensively used too.

A forthcoming vertically integrated studio being offered to students in year 2 and 3 is on vehicle design. However instead of allowing for sketch design and the traditional methods of vehicle design the students are being constrained to use spore - the multi-genre massive single-player metaverse god game developed by Maxis and designed by Will Wright - for the initial concept development stage of their design project. The vehicle editor in Spore comes with a set of parts which can be used to assemble a huge variety of options for vehicles. The vehicles thus created can be used in the Civilization phase of the game and the animated vehicles can be saved as a video file. The students are being required to submit a series of vehicles created in spore as a way to take them away from positioning their projects as constituting incremental changes from conventional vehicle design. Of the vehicles designed the students will be required to select a design or direction which they will develop further using Rhino. Furthermore keeping the spirit of the game alive is the requirement that the final submission will have to be their showing their design in a scenario of the future. The model of the design will have to be an abstract interpretation of their design as a skeleton visualized as a kit in which pieces of the car are cut out of plywood, pressed out and assembled.

Practice Story

This aspect of the work, applying the cloud to a design practice, involved significant context well before the start of this paper. A gradual shift occurred, from using simply tools like Google docs and gmail to manage collaboration, to using almost exclusively cloud based knowledge management systems like Google reader,

wikis and Google Sites, mind mapping systems like mind 42 among many others, payment and financial management systems including Mint and PayPal as well as many tools for various levels of discussion and presentation, including friendfeed, twitter, blogger, Quartz Composer (mining and displaying cloud data) and facebook. In part these tools were introduced as an exercise in using the cloud, a trial to see what was possible and how it would effect the design practice, however upon finding some of the changes very moving, the cloud became the driving force, helping initiate and enabling work opportunities that would have otherwise been impossible.

Initially the cloud was approached as away to communicate more widely and aggregate relevant online data sources in a customized mass of stored knowledge. This was done by moving blog reading and commenting to online tools, in this case mainly Google Reader, with feed management and sharing in Toluu. As more feeds became integrated into this knowledge base sharing and socially managing the data became relevant. In recent years a number of services had grown to provide advantageous RSS management features, helping users find better quality content without wasting time on meaningless noise. Though some of these are quite effective there is not a unified way to integrate them into the large world of RSS. One exceptional group is sites like Digg which offer a voting platform for the value of a link. In any case a multitude of interesting and useful data is published every day which via the efficient use of RSS is consumable, shareable and actionable. The practice of doing so had a game changing effect on the author's knowledge and ability to respond to what is new, not only acting as a platform for continuous education and exposure but also creating interest and cross pollination from a global range of sources, the people of the world. Google Reader provides a very adequate gallery context however the digital curation of this media is still not perfect and thus the designer must design the curriculum of their reading which can cause difficulty to some new users.

As the consumption of cloud media increased, so did responding to it in a designerly fashion. Releasing content to the cloud is highly flexible and can scale to include is little as 140 character sentiments on Twitter to writing extensive books or articles over the course of a blog, as was the case in the practitioner's past work. In this research however contributing to the cloud was done predominantly as a reflection to consumed media or the work of the social community. For this purpose, services like Friend Feed, and comments on Google Reader make it possible to create conversations around any kind of cloud information available in the form of an RSS or ATOM feed. Using the appropriate methods a designer can then aggregate these micro contributions to create a vast network of knowledge, similarly, as the social network surrounding the designer responds they can provide interesting opportunities to the designer. In the case of Twitter, a large community of "followers," or people who have agreed to monitor your contributions, can be formed and with this questions or thoughts can be posted and often provoke many interesting and useful responses.

The extension of creating a richer knowledge network and creating final output for a client is less supported by the nature of the cloud at this time. In this case the author extensively used services like, Google SketchUp, a

local 3D modeling software with a online sharing and collaboration system, to visit the clouds offerings of this kind. Visual communications are less of an issue as tools like the Aviary suite offer complete options for raster and vector editing [7]. Connection speed however provides an issue as large graphic or 3d data sets are not functional over a network in realtime. To deal with this, the SketchUp community provides a change management solution which gives users the ability to download and edit large files, then automatically upload them again to the original location with the changes monitored.

Presentation and the process of realtime client communication is a well supported and innovated area in the cloud. In the authors case, many interactions were on the basis of strategic decision making, as opposed to presenting design concepts and thus, in most cases video communication and documents or spreadsheets shared among the viewers were appropriate. In some situations however visual description or technology prototyping was significant. Google Presentations which offers a live group chat as a presentation is conducted proved useful for this. Additionally, prototyping certain user cases or interesting data formations was made possible with tools like the now retired Google Mashups Editor and a similarly flexible, though locally administered tool, Quartz Composer. Quartz Composer allows for an interesting bridging of the local computing and cloud computing gaps as it gives a programmer easy access to many kinds of realtime online data for use in their compositions. This was used on a number of occasions to incorporate aggregated interaction and media gathering into distributed presentations.

For the financial function of a design practice the cloud offers a limited number of significant changes, apart from the availability of some convenient border removing and analytical services. These are especially relevant for international work as payment and tax on global projects can be quite bothersome without sufficient mechanisms. In the authors case, Paypal Business was used as a payment platform with Mint as a way of managing finances. Initially invoices would be created in Google Docs however a more workflow friendly approach was found as being to create a payment structure within Paypal. As some clients, especially larger procurement offices, have difficulty using Paypal, it was often found helpful to create local bank accounts in countries visited for projects to be locally funded. That said, perhaps the most significant opportunity in this respect is for small freelance design practices to have global significance and work remotely with ease. The cloud enables interactions to go further.

3. Discussions

Having now spent considerable time learning and implementing tools of cloud computing for the purpose of design, the authors have some context on matters of the effectiveness and potential of this set of tools. Developing a workflow allowing for the effective management of online data is one step which can be of some importance for longer projects such as in an academic setting however in some cases the flexible nature of cloud data, being generally accessible and typically stored in a standards based way, allows for quick changes to the context

in which specific data is used. This is one particular area which seems to significantly impact the work of a designer as research data can be visualized in a host of ways, shared and acted upon by many participants so quickly and easily. This process of capturing data or even simply ideas, giving them some context and then referring to a community of other people able to provide some kind of response to the work is perhaps the most significant change offered by cloud computing now.

Another factor of notable impact dealt with by the authors is that of data access. However this was in some ways as beneficial as problematic in certain circumstances. In particular the shift from storing all of ones data on the computer they carry with them, to storing it on a server somewhere on the internet, introduces the issue of ensuring that you have access to it. Many parties have experimented and developed asynchronous editing solutions however few have managed to do an adequate job at this time. The best successful examples are still limited to the software development world with tools like Git and Subversion [8,9]. However some significant work is currently underway with the rise of systems like Google Gears which provides the equivalent of a local data server to host a web application on your computer when you are not connected to the internet [10]. Google Gears with Gmail and Google Docs were used heavily in the writing of this paper. One issue facing any community trying to work around these limitations is the notion that investing in sophisticated synching technology will be outmoded shortly, due to the increasing widespread availability of broadband connections, however until there is broadband saturation syncing of some sort will be necessary. Google Gears has been developed to accommodate both modes of use to some extent and thus is a good platform for developers to adopt.

In a practical sense reputation management and visibility hold more significance in the world of cloud computing, partially because by having a rich online presence a designer will be highly visible and their work and their thoughts will usually be accessible to anyone who chooses to do the appropriate search, and, partially due to an opposite effect, that some significant factors of a designers work may be difficult to represent in a web presence. In this world the user is a presence. To take part in the cloud it is less about having an attractive websites and more about a good stream of content and collection of interactions. Just as how data is interacted with is important for cloud software, the way people participate in social interaction is significant for their reputation. In this way being reputable in a cloud enabled world will mean acting as a good citizen on a larger scale than simply with your closest friends. The issue of showcasing design which does not go digital easily can be approached by creating a community around the work who can act as natural evangelists for it. A designer's ability to collect clients is thus enabled by the uniqueness of their skill and the spread of their network, which could well be indicated by a measurable trend as cloud computing becomes more commonplace for designers.

4. Conclusions

In the future designers in the context of the cloud will begin to collaborate widely and flexibly, research with crowd data, contribute to projects from any context and be uplifted by technology, not slowed by it. In this way

we can imaginably expect a shift in the way research for design is done and collected, users will be more likely to contribute to the decision making process because the information paradigm will be based on two way communication. Additionally, we can foresee rich collaboration between designers as what they work on and how they interact with it will not be locally bound. Furthermore it is supposed that objects in a cloud enabled world could begin to have their own presence. Designers dealing with this factor will need to consider a host of issues including how data is owned and how knowledge transfer can appropriately happen, also on a more practical level, what kind of interfaces are convenient and perhaps most importantly, how to effectively curate media, both for the knowledge and learning of the designer and for their effective communication with clients and co-workers. Prototyping will be a core part of this future as the availability of rapid manufacture increases and as the work of a designer moves to be a curation of the design experience. Design may change a lot due to the simple shift in the physical boundaries of where things can happen, and how many people are aware of them happening.

This paper has described some use cases for cloud computing in design, posed some analysis of this scenario and additionally looked at various possible futures which can be expected. It has neglected to engage a rigorous analysis of these elements for various reasons, one being that the cloud computing environment is changing so rapidly that only a very general analysis is likely to have lasting relevance. An opportunity for further research would be to begin to create a frame work of needs and elements which can be effectively provided and used given the constructs of the cloud. This paper has also not delved into many of the human service aspects of the cloud phenomenon, especially funded outsourcing and the creation of online delegation networks. These exist in a large way and are beginning to offer opportunities for designers, both to find work and to find people to work with. This is another direction for future research of this kind.

5. Acknowledgment

6. References

[1] Amazon. (2009) Amazon Simple Storage Service (Amazon S3). Available at < http://aws.amazon.com/s3/ > [Accessed 28 June 2009]

[2] Eran Hammer-Lahav. (2007) OAuth: Introduction. Available at < http://oauth.net/about > [Accessed 28 June 2009]

[3] Google. (2009) Social Graph API - Google Code. Available at < http://code.Google.com/apis/socialgraph/ > [Accessed 28 June 2009]

[4] Wikipedia Foundation. (2009) Cloud Computing. Available at <

http://en.wikipedia.org/wiki/Cloud_computing > [Accessed 28 June 2009]

[5] Google. (2009) Google Wave Federated Protocole. Available at < http://www.waveprotocol.org/ > [Accessed 28 June 2009]

[6] Bruce Sterling. (2006) Spimes and the future of artifacts. Available at <

http://liftconference.com/bruce-sterling-1 > [Accessed 28 June 2009]

[7] Aviary Inc. (2009) Welcome to Aviary. Available at < http://aviary.com/home > [Accessed 28 June 2009]

[8] Scott Chacon. (2009) About Git. Available at < http://git-scm.com/about > [Accessed 28 June 2009]

[9] Wikipedia Foundation. (2009) Subversion (software). Available at <

http://en.wikipedia.org/wiki/Subversion_(software) > [Accessed 28 June 2009]

[10] Google. (2009) Google Gears - Google Code. Available at < http://code.Google.com/apis/gears/ > [Accessed 28 June 2009]