

Capturing multi-stakeholder needs in Customer-Centric Cloud Service Design

Completed Research Paper

Brian O’Flaherty

*Business Information Systems,
University College Cork, Ireland.*

Email: *bof@ucc.ie*

Andrew Pope

*Business Information Systems,
University College Cork, Ireland.*

Colm Thornton

*Business Information Systems,
University College Cork, Ireland.*

Simon Woodworth

*Business Information Systems,
University College Cork, Ireland.*

Abstract

Cloud computing applications and services go hand in hand, yet there is no clear mechanism for ensuring that the cloud applications are designed from a customer’s perspective. Likewise services can require adaptation for multiple customers of stakeholders, which require differing user experience outcomes. This paper describes the initial design and development of a predictive analytics cloud service application, which uses historic customer data to predict the existing customers that are most likely to churn. Service blueprinting, a service innovation method, was used as the underlying design model for developing an initial shared understanding of the required service. Personas were used in the requirements analysis to develop insights into multi-stakeholder needs. Using the design science paradigm an extended cloud service design theory is proposed, as an outcome of the ongoing development of this analytic s platform.

Keywords: Design Science, Cloud Service design, Service Blueprinting, Personas, Customer-centric.

Introduction

The Cloud phenomenon is heralded as a disruptive concept that can change how software and associated applications and services are delivered. Much of the design effort in cloud application development has focused on technical deployment issues, such as payloads on virtual machines (Papazoglou, 2011) and uniform abstract description across, service, platform and infrastructure levels (Nguyen, 2012), while there is a lack of emphasis on customer level design. This paper explores the collaborative design of a cloud application addressing the issue of design from a customer perspective; it also attempts to frame the experiences of this application development in the context of the Design Science paradigm.

PredictX is a proposed predictive analytics service for predicting customer churn. Predictive analytics is driven by quantitative algorithms that uncover relationships and patterns from large volumes of data that can be used to predict behaviour and events (TDWI, 2007). Customer churn prediction aims to identify subscribers who are about to transfer their business to a competitor and is now preformed regularly in a computer assisted manner (Hadden et al., 2007). It is extensively used in mature industries with a high degree of competition, such as the Telecommunications industry (Dass, 2011).

This paper sets out to explore developing guidelines for Cloud-based service developers and considers the potential of theory building as an outcome of Design Science, which will be explored through further development of an analytics platform.

To fully understand the functionality and form of a service many researchers turn to service design. Service design consists of tools, which describe the customer-centric approach in new service development. Some tools are available for mapping out the service process, such as service blueprinting or service mapping.

Most definitions of a service focus on the customer and on the fact that services are provided as solutions to customer problems (Gronroos, 1990) or create value (Gummesson, 1995). Therefore, the working definition for services adopted here is;

“Dynamic set of activities which create value/solve a problem through the lens of the customer.”

Applying this to the predictive analytics platform being considered in this paper gives a more specific definition.

“Predictive analytics services which predict customer churn from the perspective of customer retention managers.”

More recent literature considers a meta-level perspective on service creation, including adopting an open innovation approach to services (Chesbrough, 2011) and the emergence of business platforms, defined as, ‘a package of interconnected digital components (hardware and software) that together deliver a set of business service’ (Vitalari, 2012). Gustafsson and Johnson (2003) argue that a service organisation should “create a seamless system of linked activities that solves customer problems or provides unique experiences”. These new directions imply that service creation requires a sound methodological underpinning that enables development of services across multiple stakeholders with a customer perspective.

In order to support this rationale, the objective of this paper, therefore, is to explore service blueprinting as a method for establishing a shared understanding of a cloud service design from the perspective of multiple-stakeholders or customer types. This objective must also be considered in the context of the overall motivation for this project, which is ease-of-use and the reduction of quantitative complexity of a predictive analytics service for non-quantitative customers.

Service Design and Design Science Methodology

The IS discipline has been addressing the challenges of theorizing design, but not explicitly from a service development perspective. Hevner et al. (2004) and Gregor & Hevner (2013) sets out the foundations of developing and evaluating IT artifacts and highlights what constitutes a good Design Science design. An interactive model with theoretical inputs and an interactive development of an IT artifact are key elements

of the Hevner et al. (2004) approach, which also distinguishes between the two paradigms in IS research, namely ‘behavioural science, which seeks to develop and verify theories that explain or predict human or organisational behaviour and Design Science, which seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artifacts.’ Other commentators suggest that Design Science should generate design theory and ‘For design research to be accepted as scientific it must generate abstract design knowledge that makes contributions to the academic knowledge base in the form of design theories’ Walls et al. (2004). Gregor and Hevner (2013) adopts a broader perspective on what constitutes theory and argues that design research can, at least in some cases, contribute to a class of theory dealing with ‘design and action’. The essence of a design theory is that it should answer questions of what and how by providing a description of an artifact in terms of its meta-requirements and meta-design (i.e. what), as well as its design method (i.e. how) (Walls et al., 2004).

In addition, design theories must show why the artifact provides an advance on all previous approaches to solving the problem (Gregor and Hevner, 2013). So as well as answering questions of what and how, design theories must also explain why an artifact should work and why it should lead to a novel or improved solution (Walls et al, 2004).

The artifact instantiation can be a component of a design theory and Gregor and Jones (2007) take a clear position on this question and they call for instantiations to be included as components in a design theory. They suggest that instantiations can serve as theory representations or expositions and, therefore, can contribute towards communicating and illustrating the design principles that are embodied within the design theory. The credibility of the design is, therefore, enhanced by provision of an instantiation as a working example (Gregor & Jones , 2007); Gregor & Hevner , 2013).

In summary, a design theory consists of meta-requirements and six further components namely, meta-design, design method, academic grounding, practical grounding, empirical grounding, and design principles. A seventh component, an instantiation, is optional, but can play an important supporting role in demonstrating the credibility of the aforementioned components.

The authors adopt this meta-design model requiring a kernel theory that focuses on the customer perspectives of services. Service design and conceptual models of Cloud computing could advance on previous methods (Gregor & Jones, 2007; Gregor & Hevner 2013), but also allow prescribed models for future development of services, including technical specifics, on the cloud. This approach can formalize customer-oriented design science, but an appropriate service design method is required.

Service Design Kernel Theory

To fully understand the functionality and form of a service many researchers turn to service design and in this paper we wish to identify an appropriate service design method that can act as a theoretical lens to support customer oriented service co-creation and ultimately theory development. Emerging in the early 1990s (Mager, 2004; Erlhoff, 2008; Segelstrom, 2009) service design tools/techniques captures not only the creativity of the development team but also the customer’s needs and experiences. Therefore, service designs can be described as using “design techniques and people centered approaches in the context of new service development” (Mager, 2004).

Service design tools that describe the customer-centric approach are considered an essential requirement to new service development, which include a wide range of techniques including interactive story boards, personas, role play, and customer journeys (; Stickdorn and Schneider, 2010). Story boarding is inspired by the cinema world and it allows the designers to put together the pictures that describe the service experience in order of occurrence. Personas involve building personality types relating to age, gender, attitudes, and location in order to represent the different segments of an organisations market (ibid). These can then be role played for a customer journey (ibid). A customer journey is a user centered visualisation of the customer experience which uses the customers’ language to create a picture of the customer experience (Erlhoff, 2008). It can be supplemented with pictures and anecdotes (ibid). One mature tool among the range of service design tools is service blueprinting (Ainamo, 2007; Bitner, 2008). More recently new blueprinting methods for designing complex service systems with multiple customer value propositions and customer experience are emerging (Patricio, 2011).

Originating in the financial services sector, the concept of service blueprinting has become an integral tool

for service designers. This is evident in the literature base where service blueprinting has been utilised to depict services in various sectors including hospital outpatients (Randall, 2008), unemployment services (Erlhoff, 2008), IT call centre (Sparagen, 2008), delivery service; vacation stay; football game; internal service innovation process (Bitner, 2008), snack robots (Lee, 2009), retail banking kiosks (Murphy, 2011) and car parking (Shostack, 1982). Despite this, there is limited evidence of service blueprinting in the design science literature.

Blueprinting is a method first proposed by Shostack (1982; 1984; 1987) and developed further by Kingman-Brundage (1993 & 1995) and Bitner (2008) to envision expected and/or actual service processes. Service blueprinting is defined as a customer-focused approach for service innovation and service improvement (Shostack, 1984). Therefore, considered as an effective tool for helping an organisation to develop new services (Hollins & Shinkins, 2006), service blueprinting is a technique that describes all activities that are carried out by a service provider and its customer to deliver a service. It helps create a visual depiction of the service process that highlights the steps in the process, the points of contact that take place, and the physical evidence that exists, all from a customer's point of view (Bitner, 2008).

Mapping or visualization of services are important as it forces the service designers to examine the service from a customer perspective and reveals to the participants the myriad of dependencies and interactions cross functions that are necessary for the service (Segelstrom, 2009). The challenge uncovered in this study related to the scenario, where a service can have potentially multiple stakeholders or customer. The next section highlights the service blueprint process.

Customer/employee Service Blueprint

A customer/employee service blueprint documents the customers' interaction with the organisation via the service. A typical customer/employee or customer/ technology service blueprint consists of five components which are described in Table 1.

Self-Service Blueprint Components	Description
Physical Evidence	All the tangibles that customers are exposed when a service process is being delivered &/or feedback the customer received after each contact with the service.
Customer Actions	All activities, chronically ordered, that customers undertake as part of the service delivery process.
Onstage Technology	Describes the interface between the customer and the technology
Backstage Technology	Describes the backend technology activities
Support Processes	Contains those hidden activities that are needed to make the delivery of the service possible.
Table 1 . Technology-Delivered Self Service Blueprint Components	

The following process, according to Bitner (2009), will create a service blueprint.

- The customer actions have been chronologically mapped.
- The actions of the contact employees and potential technology interactions are mapped. These actions are those that are visible to the customers.
- The actions of the contact employees and technology that are invisible to the customers are mapped.
- The supporting actions of non-contact employees that are necessary for the delivery of the service are mapped.

- Finally, the pieces of physical evidence are added as the last piece of the blueprint.

A service blueprint is a two-dimensional picture of service process; horizontal and vertical. The horizontal axis represents the chronology of actions undertaken by the customer and provider of the service. The vertical axis distinguishes between different areas of action separated by different lines (Hollins, 2006). These lines include:

- **Line of interaction:** Separates the customer's actions area from the supplier's action area. Above this line, activities, choices, needs and interactions performed by customers are presented. As a result, Bitner (2009) argues that a 'moment of truth' has occurred.
- **Line of visibility:** Distinguishes between actions visible and invisible for customers. Above this line one can find the "On-stage" contact and employees' actions (Front Office).
- **Line of internal interaction:** Distinguishes between front office and back office activities.

Service blueprints can describe human-to-human service innovation, as many service design developers believed that technology was not essential for service innovation (Fließ, 2004). However, described as an "important ingredient of innovation development" (Jong, 2003) technology and service innovation are closely interrelated (Polaine et al. 2013). Rogers (1995), Chesbrough et al. (2006) and Chen et al., (2007) argue that technology is a critical enabler for service innovation. It is therefore important to note that services can be delivered through human-to-technology service innovation. While service blueprinting does present a design from the customer perspective, this development project evolved, requiring multiple stakeholders and customers. Service blueprinting can allow the development of different designs, but it does not have an inherent mechanisms for deriving these perspectives. The design challenge in this project centered on supporting many potential customers/users and it became evident that the service blue-printing method does not naturally capture this detail. The persona concept is therefore explored in order to support this shortcoming.

Personas

Personas are fictional user archetypes which are used to communicate design information to users and software developers. The use of personas as a design tool was first popularised by Cooper (1997) in his book "The Inmates are Running the Asylum" where he advocated the use of roughly sketched fictional characters as a tool for improving interaction design. Since then, the use of personas has become well established within the fields of user experience (Kuniavsky, 2003), user-centred design (Nivala *et al.*, 2011) and software engineering (Pruitt and Grudin, 2003). Although Cooper (1997) initially advocated the use of rough sketches, the method has evolved to incorporate quantitative and qualitative data (cf. Pruitt and Adlin, 2006; Acuña et al., 2012). To this end, personas have been used both as a means of gathering data and also presenting data gathered using others means (Meissner and Blake, 2011).

The persona method provides a deterrent to the creation of big upfront user requirements in favour of a small subset of archetype users. As Cooper (1997) states "*merely being the victim of a particular problem doesn't automatically bestow on one the power to see its solution*". A study by Long (2009) showed that persona use was most successful during the early stages of a design project and was particularly useful in identification of target audience and user requirements gathering. Moreover, design teams using the persona method were able to identify and address problems quicker than those who did not use the method.

Personas provide designers with a proven method of avoiding personal biases and assumption in the design process (Putnam et al., 2009). Moreover, personas provide a mechanism for bringing stakeholders into conversations concerning the design process and allow the development team to focus on user behaviour rather than customer demographics (Moule, 2012). Indeed, Pruitt and Grudin (2003) state that the effectiveness of personas to provide "*a shared basis for communication*" is one of the method's greatest strengths. Such a feature promotes consensus and efficiency of decision making (Mulder and Yaar, 2007) and allows system designers to communication with a wide variety of stakeholders including: developers, designers, software testers, managers, marketers and users (Pruitt and Grudin, 2003). Indeed, research on the effectiveness of personas in culturally diverse settings (cf. Meissner, and Blake, 2011; Putnam *et al.*, 2009) reiterates the effectiveness of personas in overcoming communications breakdowns.

The development of this predictive analytics platform requires a mechanism for multiple customer perspective, which is not considered automatically from the service blueprint design approach (Bitner, 2009). The authors therefore explored the merger of service blueprint and personas as a mechanism for better understanding multi-stakeholder needs analysis.

Towards a Cloud Service Design Theory

This project is funded by the Innovation Partnership programme of Enterprise Ireland (The Irish Enterprise Development Agency). The Innovation Partnership Programme encourages Irish based companies to work with Irish research institutes resulting in mutually beneficial cooperation and interaction. In this project the development team are collaborating with Statistical Solutions, an Irish SME that develops unique statistical software applications for statisticians, clinical researchers, data analysts and other analytical professional. The development and design team consists of academics, statistical specialist and software developers. The case sets out to explore the rhetoric relating to the impact of Cloud Computing on SMEs and this paper highlights the initial experiences of using service blueprinting for developing a shared understanding of service development, particularly from a multi-stakeholder perspective. The next section explores the resultant design decisions that emerged from the experience of the development of this analytics service artifact platform.

Artifact description

PredictX is a predictive analytics service allowing the user to upload historic customer data to a cloud application, where specific data that may identify customers has been removed. The platform allows the customer to create prediction in a self-service manner. As this is a 'preliminary' version the blueprint which is developed, it is considered to be a concept blueprint. As this service is a relatively new concept the blueprint for this new service will be presented at a high level (Segelstrom, 2009). It is important to note, however, that different customer segments can have different blueprints so there may be many blueprints for one service (Segelstrom, 2009). The system is built using predominantly Microsoft technology, including using the .Net development platform, with SQL Server database and IIS web server. The algorithms used in the service are written in Fortran 77, which was encapsulated as a web service. The graphing in implemented, using the Sencha Ext Js suite. The complete system is hosted on Amazon Web Services cloud computing platform.

Stage of User Experience	Description
Service starting point	User log-in, select prediction project
Data Management	Upload & manage data (data as the precursor to any prediction)
Acquire/select data	Select data (and predictors) for model build/deploy
Build model	Build model to be used for predictions
Validate model	Approve model for use following review of estimated accuracy and identified key drivers
Deploy model	Apply model to selected data
Visualise & interpret results	View and assess generated prediction outputs

Table 2 Predict-X user workflow stages

The analytics process workflow adopted in this development is outlined in Table 2, which is a sequential set of actions that are followed by the main user of the system, namely the retention manager. The first

version of the system is applied to the publishing industry and specifically subscriber retention. The validate model and visualize results screenshots are shown in Figure 1 & 2 are examples of the complete system's user interface design. The validate model page highlights the three algorithms used by the system namely 1) Survival analysis, 2) Logistic regression and 3) Decision Trees (CHAID). The platform applies the three algorithms to historic data and selects the best performing algorithm as the default. In the example in Figure 1, Logistic regression is selected as the default, as it scored highest at 89.89% accuracy.

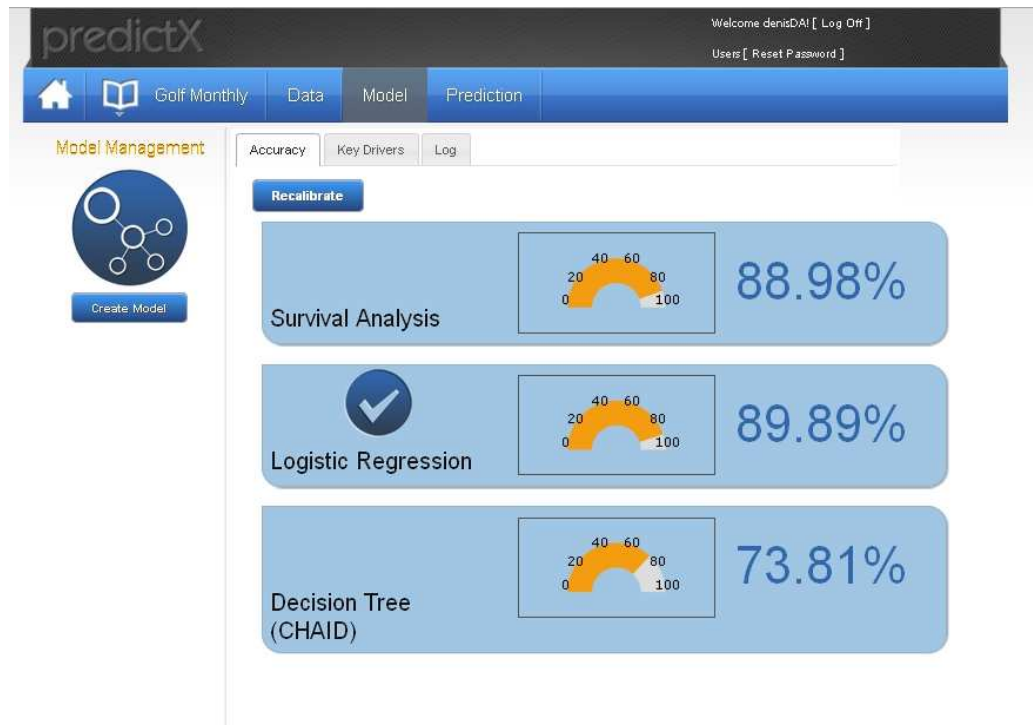


Figure 1 - PredictX Service Screenshots showing model accuracy

The results visualization page is also shown in Figure 2, which represents a curve of active subscribers based on their propensity to renew. Subscribers which are loyal are shown in the green segment, while the high risk subscribers are depicted in red. The retention manager can change the segments interactively using a slider and download the segment lists or compare segments based on the key drivers. This visualization graph is design to support the semi-structured decision making of the retention manager, while ultimately giving insights into how to optimize the retention strategy. The key stakeholders that could use the system included 1) the retention manager, 2) the data administrator and 3) the Account manager. The retention manager develops the company's overall retention strategy, while working closely with the account managers, who are responsible for implementing the strategy.

Developing a Persona-led Service blueprinting method

Service blueprints were initially developed as the output of a focus group workshop of the design team, which included developers, senior managers and predictive analytics experts. The company participants were skeptical initially and limited the time set aside for the blueprinting workshop. Much to the surprise of all involved in the process, the focus group quickly understood the model and applied it to co-creating the service design. The method proved to be very intuitive and the team reached a consensus quickly with only minor discrepancies or differences in opinion. Over the duration of the development project the service blueprint evolved and as the artifact became part of the Design Science process and it in turn inspired alterations. The role of the blueprinting was sporadic and the design reached stabilization, which required customer emersion of the artifact to develop new requirements and advance the design. This is in line with the iterative aspect of the Hevner (2004) approach. As the design evolved and more input was required from potential customers, it became clear that a mechanism to capture multiple perspectives was

required. In the later stages of the development actual potential customers, where involved in the design process.



Figure 2 - PredictX Service Screenshots showing Results visualization pages

The service blueprint also captures non-technical cloud support processes, which are an important aspect of the revenue model for cloud services. Services by their nature accumulate recurring revenue and these alternative revenue streams can be modeled on the blueprint. As the PredictX service blueprinting case is dependent on cloud technologies, reflecting on such a case allows the first elements of a Cloud Service Design Theory to emerge. One could argue that the service blueprint unclutters the technical detail and forces the designers to focus on the customer perspectives, but the design team struggled with the issue of multiple stakeholders. The implementation focuses on predicative analytics for customer churn and the key role played by individual stakeholders was developed using persona templates, an example of which is shown in Figure 3.

The persona were developed from jobs specifications of each role, such as a typical retention manager. Using a focus group with the development team and the actual customers, the personas were developed and corrected and new understanding and requirements emerged. The previous assumptions of the design team, where also challenged and had to be re-assessed. The personas objectified the roles, by making it easier for retention staff to talk about a hypothetical scenario.



Figure 3. – Retention Manager Persona example.

The outcome of the personas analysis identified a number of key requirements, which are:

- 1) Three user roles are required, which share some functionality, but also have different individual requirements. These roles are the retention manager, brand manager and data administrator. A fourth persona emerged from systems testing, where the quantitative analytics staff required access to data files and output for testing purposes.
- 2) Clarification of the key semi-structured decisions that will be supported by the system, which guided the development of the data visualisation.
- 3) Identification of the predictive models that will require operationalization.
- 4) Clarification of the workflow processes and the role of each of the personas in delivering these processes.
- 5) The emergence of an enterprise retention management process, which embeds all of the previous requirements.

The outcome of the personas allowed the development of a new service blueprint, which captured the Enterprise Retention Management process and the individual requirements of each of the personas. There were a number of notation challenges, which emerged from merging personas and service blueprints. The choice involved either 1) developing an individual service blueprint for each persona or 2) develop one blueprint, but clearly indicating which persona it related to. The design team opted for the later as the retention manager role was the most comprehensive, while the remaining two personas were responsible for lesser service functions.

The Enterprise Retention Management Process (EMP) persona versus service blueprint matrix is depicted in Figure 4 and this highlights, which personas have access to the various stages of the service. These stages are abstractly represented as service blueprints, with the whole process consisting of a total of eight service blueprints (SB1-SB8). The retention manager is most active across all of the ERMP process, while the data administrator is concerned with data warehouse issues (SB2). The Account managers can see the visualisation for their individual titles (SB7), but have no access to the other functions. A specific example of a service blue-print (SB5) for model validation is shown in Figure 5. An Actual screenshot of the actual implementation for this blueprint is shown in Figure 1a. This blueprint gives an overview of the complexity of the algorithm selection process and the design challenge centred on determining, how much of this will the non-quantitative user need to see. The design team knew that the retention manager needs to be confident in the accuracy, but they are less concerned with how this accuracy is achieved. If the reported algorithm accuracy is high then we do not need to know how, but if the accuracy drops then the retention staff loses confidence in the outcome.

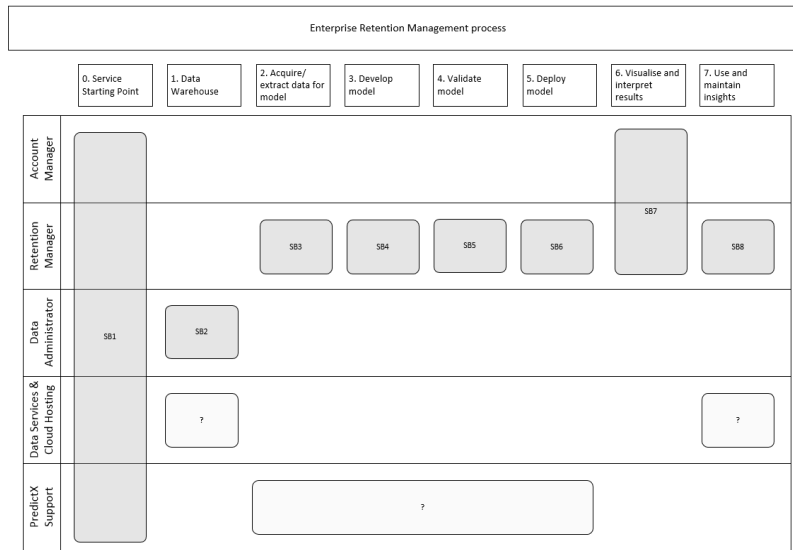


Figure 4 – Enterprise Retention Process - Persona Vs Service Blueprint matrix

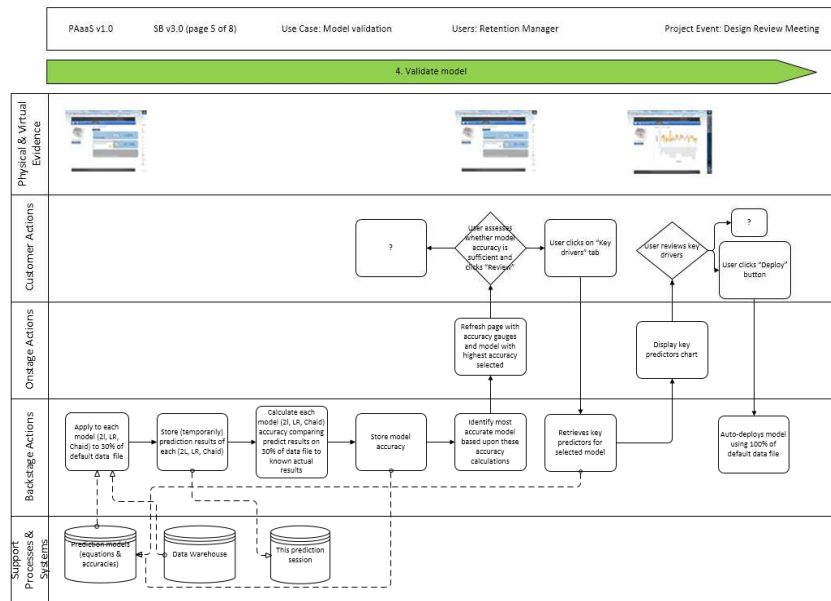


Figure 5 - Service blueprint for Model Validation

This method emerged from recognition that service blueprinting does not adequately capture multi-stakeholder perspectives. This can be considered from an integrative format, as an integrated persona-led service blueprint design approach which is presented in figure 6.

It is a recognised limitation that this is a single case implementation and it is difficult to generalise from this position. It is therefore tentatively proposed that this approach which uses personas to define service blueprints is an appropriate design theory to support more complicated multi-stakeholder service implementations.

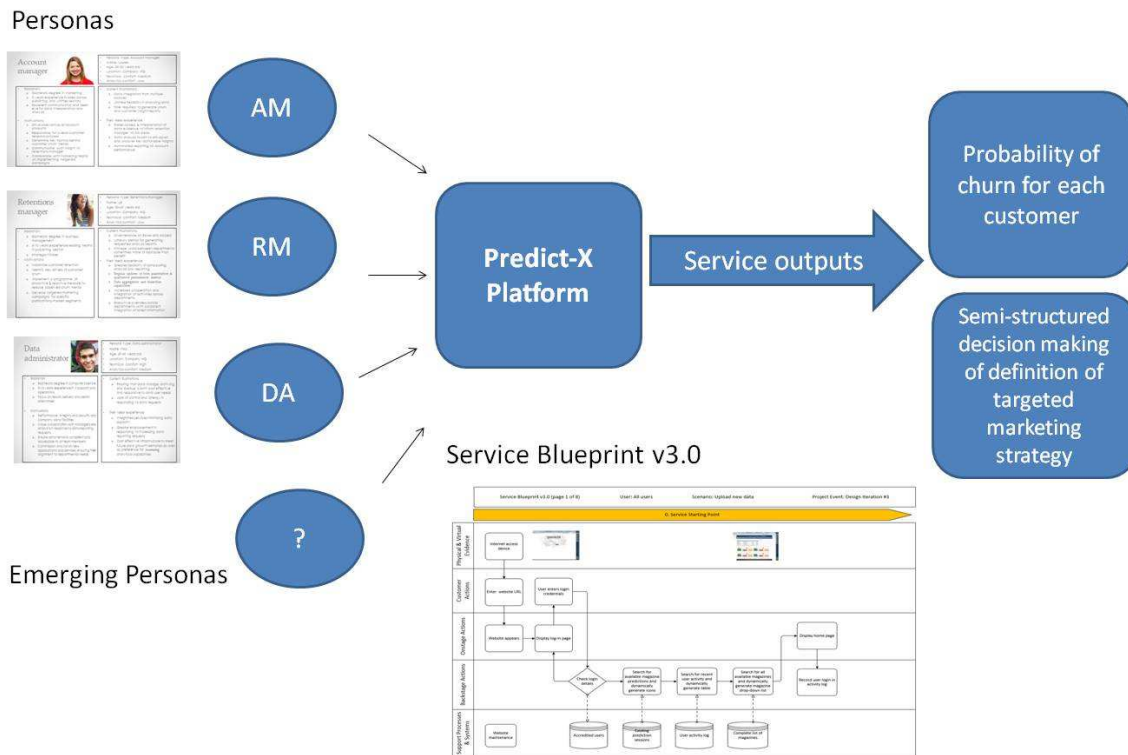


Figure 6 Integrated persona-led service blueprinting design

Evaluation of Method

Gregor and Hevner (2013) highlight the need to evaluate the artifact, but in this case it is also necessary to evaluate the proposed method. A Service blueprint workshop was attended by the entire development team, including the sponsoring company, the software development team and analytics experts. All participants were asked to give feedback at the workshop, which was led by a facilitator, as well as, filling out a follow up questionnaire. The workshop involved a ‘walk through’ of the service blueprint and, in general, the responses were very positive. While the persona information was of less relevance to the development team, the service blueprints did have a positive impact. The team realised that they operated in different parts of the Service Blueprint, with analytics experts focussing at the back-end, while the visualisation developers were working in the foreground. This gave the team a sense of how their part interplays with others or a spatial map of the service.

'Developers can see clearly what is required in their own work area, but can also see what other developers need to do.'

Developer #1

It works in establishing a shared understanding of the design, particularly as no one developer had the technical expertise to be involved in all of the development.

'Blueprints gets everyone involved on the same wavelength and more importantly, if there are any misconceptions or ambiguity.'

Analytics Expert #1

The participants in the workshop concluded that service blueprint complexity of the back-end and the extensive man-hours that went into the development. It also made clear that in order to make the systems easy to use that at times much of the complexity is hidden and this is very evident in the Service Blueprint. The development team expressed concerns with using this directly with actual customers, but it could be used to capture and share new design enhancements. One developer noted that very few of the 87 software or enhancements would have changed the service blueprint. The blueprint captures high-level processes and not specific implementation detail.

This feedback also provides motivation for adopting this approach as the service implementation has evolved beyond one developer's skills sets and deals with a range of potential stakeholders. An actual deployment of this system in the publishing industry could involve providing up to 50 account managers with their individual subscriber propensity scores. When the team reflected on the fact that it is a predictive analytics service, the service design perspective is a powerful mechanism for allowing the 'number crunchers' to appreciate the holistic picture. An implementation like this requires a diverse skill set including service design and predictive analytics professional will required service design skills in order to build services like this. The system development is still ongoing so the artifact evaluation is not complete.

Conclusion

To date, the definition and taxonomy of cloud services has been arbitrary in nature and, while both the literature and vendor papers have attempted to provide a consistent view of the variety of cloud services and technologies on offer, no comprehensive taxonomy has been offered (Chen, 2007). This paper set out to explore the development of a Cloud Service Design Theory and the theoretical outcome of developing a predictive analytics cloud service is represented in table 3. The components of the emerging design theory follows Walls et al. (2004) and the key kernel theory is 1) Service Blueprinting, which ensures customer centered design and 2) Persona mapping, which emerged on reflection from the experience of developing the PredictX service. The development of this platform is ongoing and more sophisticated blueprinting experience and models are expected, particularly as this a commercial implementation which will be licensed to the sponsoring company.

Design Product	
Meta-Requirement	Absolute simplicity and accessible to non-quantitative customers. Ease of use and hidden complexity
Meta-design	Non quantitative customers can run complex predictive models.
Kernel theories	Service Blueprinting & Personas
Testable design product hypothesis	Ease of use and non complexity.
Design Process	
Design Method	A description of procedure(s) for artifact construction.
Kernel Theories	Service Blueprinting & Cloud taxonomies.
Testable design process hypotheses	Consistent with the meta design.

Table 3. Components of a Cloud Service Design Theory (CSDT)

This paper emerged from the experience of developing a predictive analytics service for deployment using cloud computing. The development team was faced with the challenge of defining a shared understanding

of the required service. The system was intended for non-quantitative customers, so ease of use and no numerical complexity was a meta-design requirement. The service blueprinting, service design approach was adopted and it successfully facilitated the co-creation of a shared understanding, which became the requirements document for the application development. The service blueprint paradigm does make the developers consider the design from the customer's perspective, but it lacks a mechanism for being more specific with multiple stake-holders analysis, which was addressed by adopting personas for this role.

The implementation is commercial and the platform will continue to evolve. This will allow further validation and design interventions, including customization for new niche market needs. In addition, design theories must show why the artifact provides an advance on all previous approaches to solving the problem (Gregor & Hevner, 2013) and lead to a novel or improved solution Walls et al. (2004). This can be analysed and documented in future implementations and customer uptake and experiences will also support this validation.

The design science approach, as proposed by Hevner et al. (2004), Gregor & Hevner (2013) & Walls et al. (2004) provided the framework for suggesting a theory from the experience of developing a technology-delivered self-service blueprint for PredictX. The described cloud service design theory consists of two phases. The first phase uses Service Blueprinting as a lens for capturing customer centered services through co-creation and iterative evolution of the service artifact. The second phase defines the blueprint from a persona-led multiple stakeholder perspective. Gregor & Hevner (2013) identifies various levels of impact of design theories, which can vary from facilitating designs through a common language to a framework for generating new insights for describing a new class of Information Systems. While this service is in its early stages, we believe that this approach can enhance customer centric service and multiple stake-holder design for cloud computing. More testing and service implementations are required, which will ultimately drive the evolution and validation of this cloud service design theory.

Acknowledgements: The authors wish to acknowledge the funding support for this research from The Innovation Partnership programme, Enterprise Ireland and Statistical Solutions Ltd, Ireland. The conference attendance was generously supported by the College of Business and Law, University College Cork. In particular we acknowledge the input from Mary Byrne, Denis Moore, Thomas Conere, John McConnell and Andrew Grannell.

References

- Acuña, S.T., Castro, J.W., Juzgado, N.J. 2012. "A HCI technique for improving requirements elicitation", *Information & Software Technology*, 54, pp. 1357-1375
- Ainamo, A. and Ventresca, M., 2007. Services innovation: sourcing in lessons from true professionals. In *The Berkeley-Tekes Service Innovation Conferences*. Haas School of Business, Berkeley, CA.
- Berry, L.L., 1980. Services marketing is Different. *Business*, 30(May-June), pp.24-28.
- Bitner, M., Ostrom, A., and Morgan, F. 2008. Service blueprinting: A practical technique for Service innovation. *California Management Review*, 50(3):66-94.
- Carroll, J. 2005. "The Blacksburg Electronic Village: A Study in Community Computing," in *Digital Cities III: Information Technologies for Social Capital*, P. van den Besselaar and S. Kiozumi (eds.), New York: Springer-Verlag, pp. 43-65.
- Chen, J. & Tsou, H., 2007. Information technology adoption for service innovation practices and competitive advantage: the case of financial firms. Available at: <http://informationr.net/ir/12-3/paper314.html>.
- Chesbrough, H. and Spohrer, J., 2006 A research manifesto for services science. *Communication of the ACM*, 49(7), pp.35-40.
- Chesbrough, H., 2011. *Open Services Innovation: Rethinking Your Business to Grow and Compete in a New Era*. Jossey-Bass, January.
- Cooper, A. 1997. "The inmates are running the asylum: Why high-tech products drive us crazy and how to restore the sanity". Indianapolis, IN: SAMS.
- Cooper, A., Reimann, R., & Cronin, D. 2007. *About Face 3: The essentials of interaction design*, Wiley Publishing. Indianapolis, IN,
- Dass, R. and Jain, R., 2011. An Analysis on the factors causing telecom churn: First Findings (). *AMCIS*

2011 Proceedings.

- Edvardsson, B. Gustafsson, A. Roos, I. 2005. Service Portraits in Service Research – A Critical Review. *International Journal of Service Industry Management*, Vol. 16 Iss: 1, pp.107 – 121.
- Erlhoff, M., Marshall, T. & Design, B.O.I.R.I., 2008. Design dictionary: perspectives on design terminology, Birkhäuser Verlag.
- Esteves, R., 2011 A Taxonomic Analysis of Cloud Computing, 1st Doctoral Workshop in Complexity Sciences ISCTE-IUL/FCUL.
- Fließ, S., and Kleinaltenkamp, M. 2004. "Blueprinting the service company managing service processes efficiently." *Journal of Business Research*, 57, 2004, 392-404.
- Gregor S. and Hevner A. R. 2013. Positioning and Presenting Design Science Research for Maximum Impact, *MIS Quarterly*, June.
- Gregor, S. & Jones, D. The Anatomy of a Design Theory. 2007. *Journal of the Association for Information Systems*, 8, 312–335.
- Gronroos, C., 1990. Service Management and Marketing: Managing the Moment of Truth in Service Competition. Lexington, MASS: Lexington Books.
- Grudin, J. and Pruitt, J. 2002. Personas, participatory design and product development: an infrastructure for engagement. DUX '03 Proceedings of the 2003 conference on Designing for user experiences, pp. 1-15
- Gummesson, E. 1995. "Relationship marketing: its role in the service economy", in Glynn, W.J. and Barns, J.G. (Eds), *Understanding Services Management*, Wiley, New York, NY, pp. 224-68.
- Gustafsson, A. and Johnson, M. 2003. *Competing in the Service Economy*, Jossey-Bass, San Francisco, CA.
- Hadden, J, Tiwari, A., Roy, R., & Ruta D., 2007. Computer Assisted Customer Churn Management: State-Of-The-Art and Future Trends, *Computers & Operations Research* v34(10).
- Hevner, A. R.; March, S. T.; Park, J. et al.: 2004. Design Science in Information Systems Research. In: *MIS Quarterly* 28 1, S. 75–105.
- Hollins, B. & Shinkins, S., 2006. *Managing service operations: design and implementation*, Sage Publications.
- Jong, J.D. & Vermeulen, P.A.M., 2003. Organizing successful new service development: a literature review. *Management Decision*, 41, pp.844-858.
- Kingman-Brundage J. 1993. Service mapping: gaining a concrete perspective on service system design. In: Eberhard ES, Christopher WF, editors. *The service quality handbook*. New York: Amacon; 1993. p. 148–63.
- Kingman-Brundage, J., 1995. "Service mapping: back to basics", John Wiley & Sons, Chichester.
- Kotler, P. et al., 2008. *Principles of marketing*, Pearson Education.
- Kuniavsky, M. 2003. "Observing the user experience: A practitioner's guide to user research", Morgan Kaufman Publishers, San Francisco, pp. 129–159.
- Lee, M.K. et al., The snackbot. In *Proceedings of the 4th ACM/IEEE international conference on Human robot interaction - HRI '09*. the 4th ACM/IEEE international conference. La Jolla, California, USA, p. 7., 2009. Available at: <http://portal.acm.org/citation.cfm?id=1514095.1514100> [Accessed January 10, 2011].
- Long, F. 2009. "Real or Imaginary: The Effectiveness of Using Personas in Product Design." Proceedings of the Irish Ergonomics Society Annual Conference (Dublin), May 2009, pp. 1–10.
- Mager, B., 2004. *Service Design; A Review*, Koln: KISD.
- Meissner, F. and Blake, E. 2011. "Understanding Culturally Distant End-Users Through Intermediar-Derived Personas", Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment (SAICSIT 2011), pp. 313-316
- Moule, J. 2012. "Killer UX Design", SitePoint Publishing, Victoria, Australia
- Mulder, S. and Yaar, Z. 2006. *The User Is Always Right: A Practical Guide to Creating and Using Personas for the Web*, New Riders, Berkeley, CA.
- Murphy, C, *Service Blueprinting –A Lens for Service Design in Retail Banking*, Unpublished Thesis, University College Cork, (2011)
- Nguyen D., Lelli F., Papazoglou M., and van den Heuvel W., 2012. Blueprinting Approach in Support of Cloud Computing, *Future Internet*, 4, 322-346.
- Nivala, W.C., Men, D., Chen, T., and Chen, R. 2011. In Stephendis, C. "An Investigation of a Personas-Based Model Assessment for Experiencing User-Centred Design". *HCI* (6) pp. 98-107

- Patrício, L., Fisk, R., Cunha J., and Constantine L., 2011 Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting, *Journal of Service Research*.
- Papazoglou, M., & Heuvel, W.J.A.M. van den, 2011. Blueprinting the cloud. *IEEE Internet Computing*, 15(6), 74-79.
- Polaine, A., Løvlie, L., and Reason, B. 2012. *Service Design*, Brooklyn, New York, Rosenfeld Media.
- Preiss, K., 2005. Where Are the Smarts Located in a Smart Business Network?, in: P. Vervest, E.van Heck, K. Preiss, L. Pau, Eds., *Smart Business Networks*, Ch. 7 ,Springer, Germany.
- Pruitt, J and Adlin, T. 2006. 'The Persona Lifecycle, keeping people in mind throughout product design' San Francisco: Morgan Kaufman.
- Pruitt, J and Grudin, J. 2003. 'Personas: practice and theory', Proceedings of the conference on Designing for user experiences, June 06-07, San Francisco, ACM pp 1-15.
- Putnam, C., Rose, E., Johnson, E. and Kolko, B. 2009. "Adapting User-Centered Design Methods to Design for Diverse Population", *Information Technology and International Development*, 5(4), pp. 51-73.
- Rennecker, Julie and Godwin, Lindsey; 2005. "Delays and Interruptions: A Self-Perpetuating Paradox of Communication Technology Use." *Information and Organization* 15: 247-266.
- Rogers, E.M., 1995. *Diffusion of Innovations* Fourth., Free Press.
- Segelstrom, F. & Holmlid, S., 2009 Visualizations as tools for research: Service Designers on Visualizations. In *Engaging Artifacts*. Oslo.
- Shostack, G.L. 1982 "How to Design a Service", *European Journal of Marketing*, 16(1), 49 – 63.
- Shostack, G., 1984 "Designing services that deliver". *Harvard Business Review*.
- Shostack, G. L., 1987"Service Positioning Through Structural Change." *Journal of Marketing*, 51:1987, 34-53.
- Sparagen, S. and Chan, C., 2008 Service Blueprinting: When Customer Satisfaction Numbers are not enough. In *International DMI Education Conference*. ESSE Business School, Cergy-Pointoise, France.
- Stickdorn, M. and Schneider, J. 2010. *This is Service Design Thinking: Basics, Tools, Cases*, Amsterdam, BIS Publishers.
- Tien, J. and Berg, D., 2003. A case for service systems engineering. *Journal of Systems Science and Systems Engineering*, 12(1), pp.13-38.
- TDWI Research, 2007. "Predictive Analytics," *What Works in Data Integration*, TDWI Research, Vol.23, 2007, p.49.
- Vitalari, N., and Shaughnessy H., 2012. *The Elastic Enterprise: the New Manifesto for Business Revolution*, Olivet Publishing.
- Walls, J. G., Widermeyer, G. R. and El Sawy, O. A. 2004. Assessing Information System Design Theory in Perspective: How Useful was our 1992 Initial Rendition? *Journal of Information Technology Theory and Application* 6, 43-58.,
- Wreiner, T., Martensson, I., Arnell, O., Gonzalez, N., Holmlid, S. & Segelstrom, F., 2009. Exploring Service Blueprints for Multiple Actors: A Case Study of Car Parking Services. In *DeThinkingService ReThinkingDesign*. First Nordic Conference on Service Design and Service Innovation. Oslo.