Designing blockchain based services

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Abstract

Distributed Ledgers or Blockchain-based systems have the potential to provide enablers for the development of future services. By combining deep encryption, tamper-proof transparency and secure personal data to a wide variety of services, there are great opportunities for the development of new services.

In developing new service experiences that capitalise on the potential benefits of Blockchain, there are a number of key challenges. These include:

- Emerging opportunities for services provided by blockchain

- Blockchain as an Identity Enabler

- Public perceptions and confusion about blockchain

- Issues of privacy, mistrust of data storage and possible leakage

- Design methodologies for services to guide users through new blockchain automated and frictionless experiences

This short practice-based paper presents a case study and reflects on the learnings and experience of designing services utilising blockchain technology for digital identity. The paper identifies issues and problems and provides a comprehensive review of the benefits to establish a

framework for designing services around distributed ledger blockchain based services.

Introduction

Blockchain, a digital technology based on a system of distributed ledgers, has become a high-profile technology that is driving the development of new platforms and services. Initially used as the basis of crypto currencies such as Bitcoin, the technology has driven the development of a number of new business models and companies developing innovative platforms that are beginning to impact traditional industries.

Blockchain builds highly secure records of transactions that cannot be altered. Blockchain services have initially focused on finance and payment systems but new services are in development especially around blockchain identity validation. These new models deliver secure, validated confirmation of people that is driving a new level of transparent and seamless customer experience. This paper describes a case study of service design practice around Blockchain-enabled identity services.

Introduction to Blockchain

Blockchain works by combining a system of timestamped records that are linked by complex encryption algorithms. Any transaction can be recorded in a "distributed ledger" and validated by a peer to peer system that effectively ensures that the record cannot be altered.

Blockchains therefore provide a highly secure basis for any type of transaction. This level of tamper-proof security has driven the development of cryptocurrencies (Nakamoto 2008), where highly complex Blockchains are used to "mine" coins that can be traded, without the requirement of a financial platform as provided historically by the banking industry.

Beyond cryptocurrencies, other applications have developed. "Smart Contracts" allow for automatic and instant distribution of funds between various parties (Bartoletti & Pompianu, 2017). This is used for financial transactions and simplifies back end systems.

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Individual components can be tracked along the supply chain and the origins of produce can be validated. Aero engine parts, for example, can be logged with a blockchain that validates their source and history, ensuring that fake or substandard parts do not make their way into maintenance and repair systems. (Korpela, Hallikas & Dahlberg, 2017).

Blockchain-based companies such as Evernym (www.evernym.com) have developed potential applications across finance, healthcare, government and insurance. Blockchain enables trusted digital relationships using the concept of "self-sovereign identity" which provides secure digital identities in the domain of the user rather than having them stored by social media or in data banks. (Der, Jahnichen & Surmelli, 2017). A number of companies have developed Blockchain-validated identity systems to create digital passports for passport processing for international hub airports. (Rowan Kelleher, S. 2019). This case study focuses in detail on one example.

In recent times migration from conflict zones such as Syria has led to large numbers of unidentified refugees. A range of biometric devices from fingerprint readers to voice recordings have been piloted to establish identity. Identification enables tracking of aid and predicts where resources are required. The GSMA report "Refugees and Identity" (2017) reports how the UN has been forefront in developing biometric and blockchain-protected identities – though there are concerns with refugee identity being dependant on complex technology systems. (Latonero, 2019)

Service benefits of Blockchain

Nascent examples of blockchain innovation are opening up new possibilities for enhanced service and customer experiences. In describing the core enablers that blockchain provides and combining these with various types of data, new opportunities begin to emerge. The core enablers can be described as:

Trust - blockchain is "secure by design" – the system has been designed to be impossible to tamper with and the chain makes visible any change in the sequence. When connected to an authenticating body such as a passport office, a high level of authorisation and validation of a person's identity is enabled. Current systems of validation require face-to-face identity checks and documents that prove address and occupation. A

secure blockchain-based digital system can be applied to further private data such as financial or medical records.

Data security – The strength of validation provided by blockchain allows access to data or services with a high degree of certainty. Contracts, components and people's identities cannot be tampered with or faked. Access to an individual's data can be restricted to that person only, removing threats of data and identity theft.

Safe, immediate transactions – linking the identities of two parties in a transaction removes the possibility of failure or misdirection. Other parties cannot hack in to reroute or cream off any part of the transaction.

Frictionless service experience - Direct immediate transactions create the opportunities for seamless events and experiences to replace previously complex processes.

Compliance – rules, policies, anti-bias patterns, personal preferences and behaviour can all be built into blockchain transactions to ensure transactions are compliant, safe and accurate. Human error or bias is removed.

Service problems of Blockchain

When designing blockchain services, there are a number of elements that are problematic to the development of better service experiences.

"Blockchain" - Recently, business and industry reports are increasingly wary of the term as interest in companies has waned due to slow delivery. Gartner (CIO Survey 2018) published research claiming only 1% of companies were adopting blockchain. Blockchain companies are increasingly using the term "distributed ledger" to reduce the negative sentiment around blockchain.

Blockchain is poorly understood by consumers. Associations with criminal behaviour and risky crypto currencies has developed a critical narrative. (Marr, 2018)

Environmental impact – Cryptocurrency platforms require huge numbers of calculations for encryption. Energy is required to cool data centres and this is increasingly being noticed by an environmentally--ware society. (Potter, 2020)

Interoperability – There are different platforms being developed for both public and private access. Other platforms are being developed for cross-industry sharing. The Corda platform for financial consortium R3 (2019) is an example of a platform that will serve a large number of financial institutions. The ISO Standards system is working to create policies and agreements to enable easier multiplatform solutions.

Emerging practice in Service Design

Blockchain services provide benefits that have the potential to simplify and transform normally complex processes. The resulting customer experiences are radically different from existing services, with the potential to deliver seamless and transparent services, but at the cost of confused navigation and lack of confidence in systems that are hidden from the person using the service. As these alternative systems are developed, service design thinking is being applied to understand their impact and orchestrate the new processes and experience in order to:

- Bring a human-centred approach to the overall experience that blockchain plays a role in and ensure user satisfaction.

- Orchestrate the new processes that blockchain has removed or simplified to ensure they are easily understood

- Ensure user control and transparency of blockchain systems and the use of data

Digital passport case study

To describe how service design methodologies are being used to form new Blockchain services, this paper focuses on a case study of the development of a blockchain identity system for use by air travel passengers by the UK company ObjectTech (www.objectivetgg.com)

The company was asked to develop a blockchain system for an international hub airport that would be capable of handling large numbers of passengers arriving or in transit at a volume that current human or automated passport readers would find impossible to manage.

The current process requires each traveller's passport to be examined. The document is the internationally accepted method to enable people to cross international borders. As a physical paper document, it can be lost,

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stolen or forged. For people who are marginal in society, who are homeless or refuges, identity papers or passports are missing or unattainable, thus denying access to essential life services.

The processing of large numbers of international travellers at airports has driven the development of automated passport reading machines. Using facial recognition and document readers, it is possible to reduce the numbers of staff and increase the speed of processing.

The concept for a Blockchain passport is to go further and develop a completely automated system that authenticates identity in the background during the travel process. Facial recognition is used at points of entry to airports and validated against a passport authority-issued blockchain. The passenger simply walks into the airport and off the plane at the other end without any interaction.

A number of system elements are required to create a secure identity validation system.

- Biometric validation of a person, through facial recognition from digital cameras. This is placed at departures and arrivals to authenticate the person's identity.

- Validation organisation - a body that issues national identity documents such as a passport office.

- An agreed blockchain protocol (ISO) that allows a blockchain identity to be issued by the identity validating body (passport office).

- A safe data bank and access protocol that allow service providers to access the blockchain-validated identity.

Once these elements are in place, the system of passport control becomes invisible to the passenger and international travel becomes completely seamless. A travel experience that becomes invisible raised concerns as to how people would find such an experience. The design team used service design methodology and tools to work alongside the technical team to explore these possible issues and design the experience of digital identity and overall human experience.

Service Design methodology

The project applied a design process that followed the "Double Diamond" methodology described by the UK Design Council in 2005. (Ball, 2019) This provides a useful high-level framework with which development and

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- Individual Young Travellers

The team compared current travel experiences with new journey concepts to gain insight into the reaction to an invisible, automated process.

The research group identified a number of issues:

- The removal of passports provides a seamless experience but passengers showed that this was initially confusing and uncomfortable. Without feed-back to acknowledge that they were passing through the system, passengers were unsure when they were free to leave at their destination.

- The absence of a physical document is unnerving and creates discomfort for people. Many of the research group were concerned about system failure. In addition, there are features of a physical passport such as visa and entry stamps that provide a record of travel which have strong emotional value.

- Facial recognition left passengers uncomfortable and raised questions about how images would be stored or would be reused.

- The research group found it difficult to understand Blockchain encryption and were worried by negative perceptions and whether it was trustworthy.

- Passengers struggled to imagine the benefits of enhanced personal services and experiences.

Designing the Blockchain journey

Refection on the research findings identified that the lack of tangibility of the process, despite the advantages of seamless experience, led to discomfort and unease, especially in first use. The results informed the designers that it was important to match people's expectations and aid understanding of where they are in the process to accelerate trust in such a radical new experience.

The service design team used an established 5 step journey framework to create new journey concepts. Taking a passenger view of each step of the journey, the "delta" or difference from the familiar historical passport process created by the blockchain system was mapped.

Journey Stage	Awareness	Engage	Use	Grow	Advocacy
Event	Advance notification of new passport process	Entering point of departure	Idenity validated passport and visa approved	Confidence in process and use of data	Extending use of blockchain services
Issue	No touchpoints or interactions with users	Facial Recognition invisible to users	Automatic validatation, process is invisible	Ensure confidence in process and use of data	Showing value in other uses: payments, health
Design Solution	Advance education and touchpoints to explain process	Provide digital process tracking to educate and set expectations for seamless experience	Notifications to communicate progress and confirm successful entry	Transparent trip records, digital passport , permission & control.	Standardisation, protocols, seamless sytem & multiplatform integration
Touchpoint	Emails, time and location notifications close to point time of travel	Applications, geo alerts to notify start of the passport process	Device notifications, alerts, haptics confirming progress	Personal data vault, secure identity app, national passport identity	Secure personal access & control via apps

Figure 1 – Journey framework used to analyse issues and identity design solutions for the new Blockchain digital passport experience.

The output of the journey mapping process led to a series of design workshops to develop new journeys which were turned into prototypes for further user testing with the research group.

Emerging Themes

When combining the overall concerns of the research group with the analysis of journey scenarios, themes began to emerge where specific design interventions could manage and support users through the experience. From these observations, the team identified several themes in designing for Blockchain.

Transparency.

Creating a narrative that explains the underlying processes and the benefits that they bring helps build confidence.

Seamless Connected Services

Blockchain removes physical steps, interaction with systems, duplication and form filling. A "once only" philosophy to data entry joins up platforms, service providers and systems to work together.

Personalisation

Blockchain creates highly personalised data that systems can use to learn about our behaviour and respond with information and services that are tailored individually. This provides an opportunity to both protect and allow for data to provide an unimagined level of automatically personalised services and customer experience.

Human Centered Collaboration

Blockchain is developed by experts in encryption, complex algorithms and quantum levels of mathematical theory. Service designers bring their techniques of human-centred design, problem reframing, creativity and prototyping to ensure that the unique qualities of blockchain are in the service of customer experience and will deliver systems that are trustworthy, safe, secure and transparent. A collaborative approach delivers a collective vision of usable and effective blockchains services

Future vision for Blockchain services

As the service experience emerged, the design team wanted to visualise the possibilities and create a vision video showing how the digital passport experience will transform travel and showcase innovative new services and experiences. The video can be viewed at
https://www.objectivetgg.com

The following images from the video capture the key elements of the experience and potential new services.

Figure 2 – Scenario 1 - Seamless entry.

Facial recognition matches blockchain data to validate individual identity, making international borders frictionless and processes invisible. Mobile phone notifications and haptics can confirm that the passenger is free to enter the country.
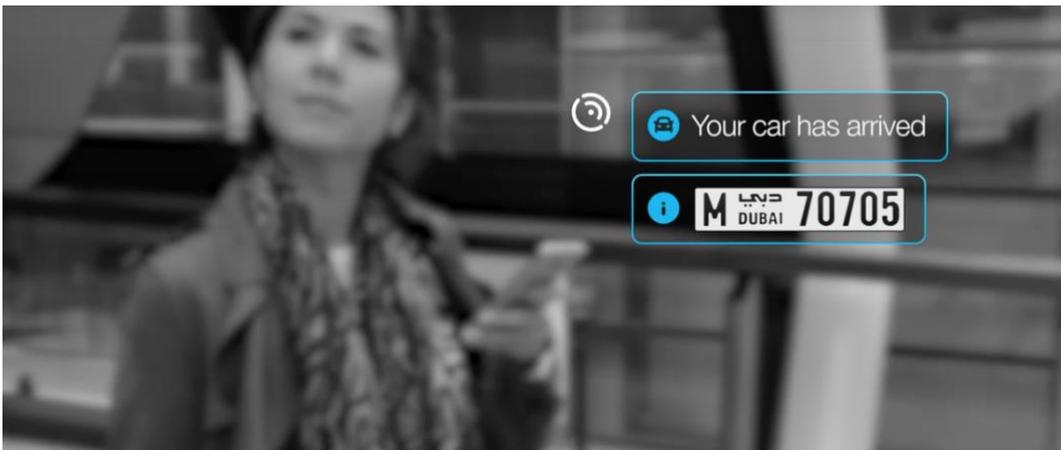

Figure 3 – Scenario 2 - Identity Transaction

Identifying and validating a driver provides safety and confidence in service providers.

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Figure 4 – Scenario 3 - Payments

The ultimate driver of identity is payment transactions. Taking the 2018 Amazon Go (2017) vision to its conclusion, identity-enabled systems allow for immediate and transparent payments where you chose your item and walk out of the store. In this case the trip is paid for automatically using an identity-validated digital wallet connected to a bank account.

Figure 5 – Scenario 4 - Recognition

The Internet of Things promises a new level of personalised services using data to proactively connect you to products and services. In this case identity recognition is enabling a personalised greeting and for any personal preferences to be matched to the customer. Room entry is automatic as you approach the door.
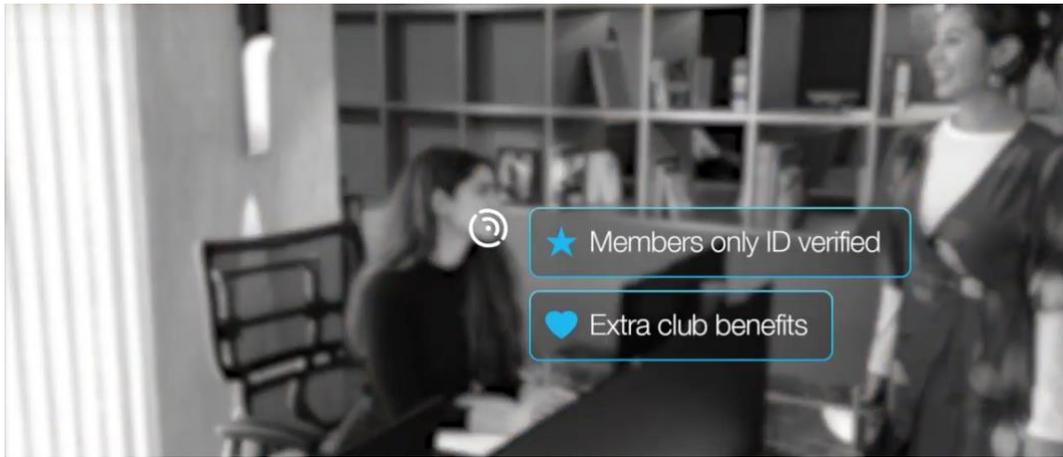
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Figure 5 – Scenario 5 – Access

Identifying access to exclusive services and building loyalty reward programmes.
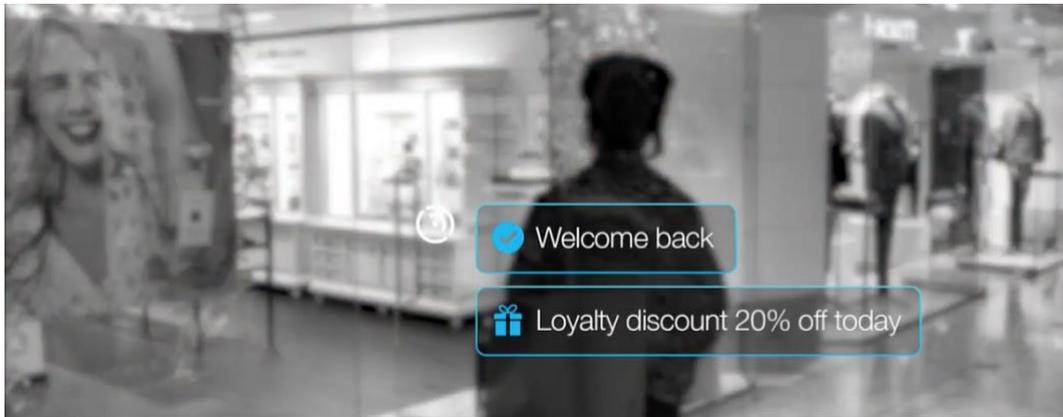

Figure 6 – Scenario 6 – Retail Experiences

Identifying at a store entrance unlocks recognition and personal incentives to shop and build loyalty - making data sharing valuable and desirable.

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Figure 7 –Scenario 7 - Personal Data.

In the example of medical data, relevant information can be shared, securely and in confidence. Proactive warning of allergies, medical history and preferred methods of treatment can be shared in an instant with any medical service provider.

Emerging design principles for Blockchain services

As the final design of the Blockchain Digital Passport and other services connected to it progresses, a series of principles have emerged which can be applied to any blockchain-enabled service.

Design blockchain services as a journey, not a process

The design methodology of mapping out how people will engage and gain trust in new seamless systems requires journey signposting, confirmations and points of access. Mapping creates better user experiences that build confidence in new services amongst users.

Build in affordance

Clues and triggers enable comprehension and communicate key stages of the process. They signify what is about to happen or has happened and can be viewed or modified.

Create permission interfaces

Control of access to data by third parties requires an interface. This can be a set of variable settings from totally private, emergency-only data exchange to access-to-all, where service benefits may be desirable.

Be proactive

Advance education, explanation and event warnings in their context allow users to be chaperoned though processes and understand when automated blockchain identity processes have happened.

Memory

Blockchain provides a tamper-proof memory of every transaction. For many applications there are strong practical and emotional reasons to provide access to an accurate record of historic transactions and events.

Cross service access

Blockchain identity can be used across a wide range of services which require individual log-ons, form filling and re-use of data. Blockchain can provide trustworthy information on identity or transactions without repetitive form filling and duplication.

These principles are the basis of an evolving set of design guidelines for exploiting the benefits of Blockchain and other "covert" systems that remove familiar human processes. The intention is to validate and improve as further applications are designed.

Conclusions

As we travel into the 4th Industrial Revolution enabled by AI, Machine Learning, Big Data and Blockchain, service design practice and methodology is vital in translating and transforming technology opportunities into human benefit. Design methods shape technologies to be future-proof and human-focused and in doing so remove both economic and social risk.

Embracing the core components of blockchain as a service enabler allows us to move to new levels of experience design beyond the constraints of many systems and processes. There are new challenges created by the transparency and invisibility of blockchain-enabled services – how do we design a digital identity system we and others can trust? Do we understand and have confidence in systems we can't see? How do we stay in control of decisions that have become automatic and may have unwanted consequences?

Applying service design practice and methodology is shown in this example to assist in maintaining human comprehension and control. The tools of service design practice- to envision, speculate, critique and shape - are vital to the development of the next generation of experiences. Blockchain has the potential to free us from process, system-based restrictions, bias and prejudice and form filling. Whether we are designing

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how to cross international borders, the customer experience of Prada or validating identity in the refugee camps of Turkey, service design practice and methodologies will help organisations ensure people accept and embrace the benefits of technology innovation and create transformational experiences that work for all in society from the wealthiest to the most vulnerable.

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