

CREATING A PRIMARY MARKET FOR PERSONAL DATA EXCHANGE IN AN ERA OF IOT: THE HAT

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ABSTRACT

Personal data generates positive benefits but also brings about negative externalities. In order to harness the benefits and remove the externalities, we propose the need to create a primary personal data market. Most existing research on market creation have taken the post hoc approach by describing and reflecting on existing markets as something out there. By taking institutional and economic approaches to market innovation, using the HAT as a case, we empirically investigated how a new market could be designed and created. In this paper, we present the preliminary results of creating a personal data platform to enable the emergence of a primary personal data market.

KEYWORDS

Primary personal data market, design science methodology, personal data platform, market innovation, institutional approach

INTRODUCTION

Personal data/information is defined as 'any information/data relating to an identifiable natural person' (Bonneau and Preibusch 2010). In an Internet of Things (IoT) era, personal data refers to much more than just credit information, address, email etc. It includes location, usage of objects and devices, diet, fitness; all information that could on one hand be incredibly valuable to firms but on the other hand, very intrusive.

For firms, personal data generates positive benefits. It enables manufacturers to deliver holistic product experiences for consumers (Fleischmann et al, 1997). In the retailing sector, personal data can enable real-time personalisation and by giving customers' near-purchase-decision promotional savings (Brown, Chul and Manyika 2011).

For individuals, disclosing personal data could bring about benefits: immediate monetary compensation (e.g. discounts) or intangible benefits (personalisation and customisation of information content). Prices might be reduced and targeted ads could better inform consumers. However, disclosing personal data also brings about costs and negative

externalities such as loss of control and privacy (Calo 2011), uncertainty, psychological discomfort, embarrassment; even time and effort with higher prices paid due to (adverse) price discrimination.

We argue that the above externalities could be internalised into becoming a primary exchange economy to be established around personal data. This primary exchange does not exist currently because consumers do not really exchange personal data on the Internet. They give it away, usually through a two-step process. The first step is by generating data through their actions, either by filling a form online or walking 10,000 steps tracked by a wearable. The second step, which occurs automatically, is the transferring away of the data because the technology that enables its collection, be it the web form or the wearable, was designed and created to transfer the data generated straight onto the firm's server. The custodial rights for personal data are therefore held by those collecting information about individuals and not by the individuals themselves (Shapiro and Varian 1997; Laudon 1996). This data then creates a secondary market between firms, as it is sold for aggregators to gain more insights.

We argue that the current Internet economy does not have any explicit way for personal data to be exchanged by the source i.e. individuals themselves. This indicates the lack of a primary market. Personal data is just given away by consumers through Internet activities. However, personal data is co-produced. It is information about the consumer, generated using the technology created by the firm. Hence, as a co-produced entity, we argue that it could be shared with both the firm and the consumers themselves, if consumers owned an information-processing platform that stored and used their data for their own benefit. We also propose that when both firms and consumers have access to such personal data, a more explicit exchange can emerge, and a wider economy of services involving personal data exchanges can be enabled; one that is privacy-preserving and valuable to both firms and users.

Our paper presents the results of creating an explicit personal data exchange platform – the HAT and the Data Exchange infrastructure.

LITERATURE REVIEW

From an economics perspective, the creation of a new market necessitates the removal of obstacles such as lack of contact between buyers and sellers, knowledge asymmetry between reciprocal needs and wants, disagreement over price and the need to exchange custody of goods, no confidence about insurance in case of default (Casson 1982, p.164; cf. Loasby 2001). The removal of such obstacles to achieve better

coordination and create information asymmetry has been discussed from early literature on markets to recent times, eg. by Alderson and Cox (1948) who considered the reduction of transaction friction, by Casson (1982) who recommended creating a set of conventions and rules, and the role of institutions (Loasby 2001, p.298). As a result, it is widely acknowledged that markets are the products of investment in continuing transaction capability, accessible to many and constituting a form of public good (Loasby 2002, p.119) that needs to be created and maintained (Loasby 2001). To develop these conventions for exchanges, producers and customers must have a shared understanding of what is being exchanged and why.

For several decades, a market is primarily deemed as something out there (being) (Alderson and Cox 1948) and a natural given. If there is a product then there will be a market (Loasby 2001; Darroch and Miles 2011, p.723). However, it is increasingly accepted that markets 'become' through human effort (Alderson and Cox 1948; Casson 1982; Loasby 2001). It is suggested that 'the process of market creation is a largely a process of institutionalising certain shared understanding and practices of exchange' (Fligstein 1996; White 1981; Humphreys 2010). A term used to describe this process is legitimation, encompassing cognitive legitimation (spread of knowledge of a new venture, Aldrich and Fiol Malkene 1994) and socio-political legitimation (...acceptance of a venture by public, government etc as appropriate given existing norms and laws...Aldrich and Fiol Malkene 1994). The legitimation process would result in the legitimacy of these new products, ideas, practices and institutions. Thus, much attention has been paid in marketing to the legitimation and legitimacy process of products and exchange practices in understanding new market creation.

The institutional approach has embraced the social constructionist notion of market. Social constructionists hold the belief that shared agreement between social actors shape and govern their interactions and perceptions (Berger and Luckmann 1966; Gergen 1985; Hirschman and Holbrook 1992; Sarbin and Scheibe 1983; Schutz and Luckmann 1973; Deighton and Grayson 1995). The shared understandings, as the fabric of social reality (Schutz and Luckmann 1973, p.22-24; Deighton and Grayson 1995, p.661), provide the "prescriptive and proscriptive rules for social conduct and meaning ascription" (p.661). These shared agreements could be reached at three levels¹ of agreement. According

¹ (1) private agreement (reached between two people; this type of agreement 'remains tenuous, easily changed...') (Berger and Luckmann, 1966, p.58-59) (2) local consensus: with more people joining, the agreement becomes "this is how things are done here" and with the local consensus become widespread, it is said to have become institutionalised (Berger and Luckmann, 1966, p.54; Deighton and Grayson, 1995, p.662); (3) institutionalised consensus/agreement.

to Deighton and Grayson (1995): “Any new market is the outcome of the continuous negotiation from private agreement, local consensus and institutionalised consensus/agreement between three forces: (1) what the marketers want; (2) what the customers want; and (3) what the institutionalised reality will allow (Deighton and Grayson 1995, p.662).

In our research context, we would integrate these approaches and through a design science methodology, investigate the emergence of a new primary market for personal data through the creation of the HAT platform.

METHODOLOGY

Most business research is based on a descriptive and explanatory paradigm. It seeks to describe and explain the present and the past from the perspective of an observer. It is a ‘rear view’ mirror version of the world and while it has created notable insights, it is nonetheless a quest for understanding, rather than transforming. Design science research focuses on the ‘front ‘windscreen’ view to not only improve on the present, but also provide guidance for the future. Engineering and medicine are some examples of such an approach, which takes the perspective of the practitioners who seek to improve the present (see Van Aken, 2004 on the paradigms issue). While the approach is forward-looking, the description and prescriptive approach of the design science methodology is not seen as an opposite; it is actually complementary, much like driving a car would require a rear view mirror and a front windscreen. As described by Van Aken, Chandrasekaran and Halman (2016), “The first provides a solid foundation for the second by cultivating a deep understanding of the field problem for which the second component produces improvement-oriented knowledge”.

PRELIMINARY RESULTS

Our study generated the following design principles for the building of a personal data platform for a primary market to emerge:

- a) A database owned by the individual, held in a microservice container, is the optimal solution to establish legal ‘super’ rights for the individual to enable personal data exchanges to occur (Principle of ownership)
- b) A containerised database of personal data would need a set of microservices to allow users themselves to be data controllers and in some cases, data processors (Principle of control)

- c) Microservices in the container owned by the user that handle the user's personal content and data has to be open-sourced to create trust through transparency (Principle of scrutiny)
- d) An exchange infrastructure to handle private, semi-private and public Data Exchanges would need to be established (Principle of intermediation)
- e) Services within the exchange infrastructure would need to be designed and ascertained if they should be private (individually controlled) services, platform services (public) or business services so that privacy isn't 'leaked'. (Principle of privacy by design)
- f) At the initial stage, the single player on the platform builds all necessary infrastructure services as well as services of other players to attract new entrants (Principle of 'service to the edge')
- g) New entrants to the platform take over various mediating services as new business opportunities, and the platform re-modularises with every new entrant where core platform services become stronger while 'edge' platform services handle the variety of users in the market (Principle of modularity)

DISCUSSION

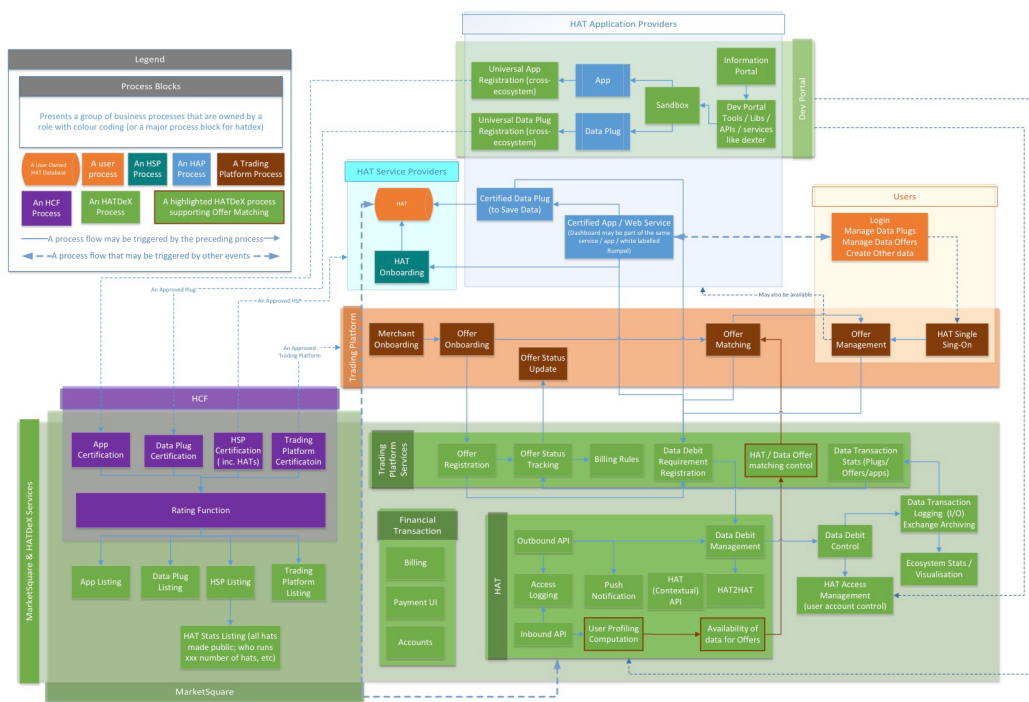
Our findings show that the challenges of emerging a primary personal data market means the proliferation of private, standalone databases for personal data that can be owned, solely controlled and used by individuals.

These privately-owned databases have the potential to turn individuals into data controllers and processors, in the same way PCs liberated individuals from mainframes in the eighties. This can be accomplished by using containers that encase various discrete components of application logic and require only minimal resources to do their job. Unlike virtual machines, containers do not need an operating system. Instead, they call for operating system resources via an Application Programming Interface (API). Containerising databases in this way can isolate them at the (micro) server level. The content within them can be encrypted and backed up regularly, and traditional direct database access replaced by server-level API calls. This isolation creates an added extra layer of security, localising the impact of any breach and mitigating the risk of sysadmin-granted unauthorised access. Through containerisation, modular and micro cloud services are beginning to supplant large cloud architectures due to their portability and scale.

The implementation of such 'microserver' containers as private data accounts is seen as a universal best practice. The architecture of a

containerised private database with microservices is found to have a few advantages. First, a user's personal data sitting within his or her own dedicated database means that data at rest within that database can be legally owned. While data may not be own-able (Cesar et. al. 2017), databases can be, and there are various case laws to support this. Users who are the legal owners of their personal databases can therefore be afforded all of the property rights of the database, reducing ambiguity, cost and friction. The database can be treated as property – i.e. a good – that confers upon the individual its bundle of rights: the right to use the good; the right to earn income from the good; the right to transfer the good to others; and the right to enforce property rights over the good. More importantly, digital assets within the database can be managed and used, and become part of the individual's estate, much as would the physical assets within a home.

Figure 1: The HAT Data Exchange architecture



Containing one individual's data within an entire database allows the individual themselves to become a data controller, and to some extent a data processor as well, operationalising the bundle of rights to which they are due. Individuals can exchange the personal data within their database for their own benefit, deriving income from it or transferring it

for fun or service if they wish. The containers themselves help individuals do this, using standard APIs, whilst the individuals themselves stay in full control. Transfers and exchanges set up by the data controller, with the accompanying reduction in ambiguity, means that bargaining solutions (trade) can be achieved. This enables a new primary market for personal data that is acted upon by individuals, rather than corporations.

The study also instituted an exchange infrastructure (see Figure 1) that facilitated semi-private data exchanges between embedded individual private containers and their service providers; fully-private data exchanges between individual private containers; and public data exchanges in which data leaves their containers for the benefit of third parties with meaningful consent.

Our study proposes that such an infrastructure incentivises a market in three places. First, as trust brokers for the provisioning of private data containers to other third-party firms and users. Second, as a facilitator of market exchange, an infrastructure of this sort could facilitate inter-organisational and organisational-individual exchange. Third, as a provider of tools, apps and services for private data use where there is no access to user data (e.g. through the creation of bots and AI analysts), and finally, as enabling services for peer-to-peer data exchanges (e.g. food or car shares).

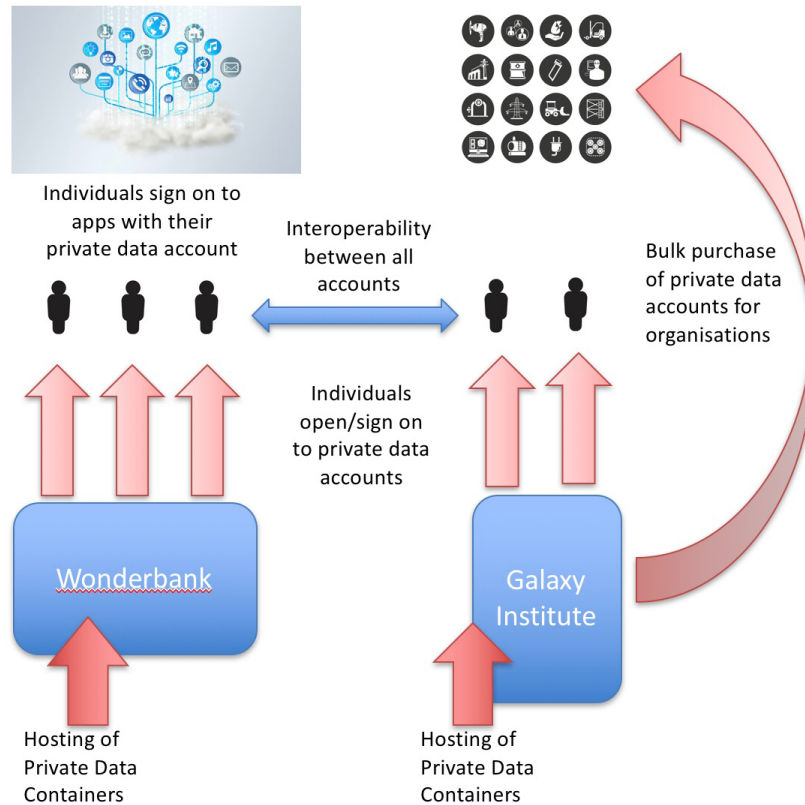
Where the need to integrate personal data containers into the established ecosystem is of initial concern, the platform is designed to benefit the actors in the IoT-led digital economy of the future. For these new entrants, the value proposition of a personal data ecosystem with a steady supply of diverse personal data provides a competitive advantage that can be used to challenge incumbents.

To ensure the ubiquity of private data containers, and to maintain an unencumbered system, multiple channels were empowered to provision private data accounts. Firms can be free to adopt and provision accounts themselves, or use third-party service providers who emerge to perform this task. The same also goes for any individuals who come directly into the ecosystem.

In this respect, the provisioning of private data containers is analogous to the provisioning of an email or bank account, creating an implicit market for trust brokering (see Figure 2). Organisations could step forward to provision private data container accounts for the consumer market in much the same way they do bank accounts, or email accounts (when they come from a trusted provider). A business-to-business (B2B) channel could also come to exist, if organisations that do not want to risk

holding onto personal data commission private data containers in bulk for their users. Organisations' HR departments may choose to provision such accounts for their employees. By having large organisations provision private data accounts for individuals, and establish identity over those accounts with their own branding, they could even use them to cultivate competitive differentiation against their rivals.

Figure 2: Trust brokering with private data accounts



Small companies in the IoT sector, for example, could integrate with private data accounts to mitigate the risks inherent to personal data security. This would spur greater growth and innovation in the sector, with a reduced cost of secure personal data containment.

In addition, as each ecosystem member increases the supply of personal data into the private account ecosystem, every other ecosystem member gains the opportunity to request that same data back from mutual customers to improve the value proposition for their own services. If a

single market-leading social firm, financial services firm, cyber security firm, IoT firm, and health services firm were to simultaneously offer a single customer set services within the ecosystem, a near-comprehensive dataset over the individual consumer might be obtained, all with the customer's permission. These firms would find a significant competitive advantage within this environment.

Personal data regulation coming into force around the world is beginning to compel firms to give individuals the right to access their own data, which may expedite this process and prompt leading firms to overcome their initial reluctance to embrace alternative data models. Others still reluctant to outsource personal data storage to individual private containers in their entirety can opt to continue holding onto some or all of their customers' personal data as data controllers in their own right. The private data account simply allows individuals themselves to do the same. The marginal costs of data duplication are negligible – though the additional security risk would still affect the firm.

Table 1: User, industry, and society benefits from the personal data platform

Benefits to users	Benefits to organisations	Benefits to society
More private	Lower risks & costs of personal data containment (assuming no duplication on the firm-side)	Better representation of individuals in the digital economy
Ability to use & re-use personal data for themselves	Champions digital empowerment & control	Enables peer-to-peer services without third-party involvement
Ability to buy services to organise & manage digital selves & personal effectiveness	Creates trust with customers	Enables individuals to engage with public services more seamlessly through data sharing

Ability to make more informed decision based on historical & on-demand personal data	Create direct customer relationships rather than be dependent on third-party supplier of personal data	Better operationalisation of a consent-based digital economy of personal data
Ability to buy intelligence services for computation & recall	Better quality of data as individuals are stakeholder of data quality	Creates disincentive for secondary (and/or illegal) personal data markets since there is a primary market
Ability to share data for insights, recommendations	Increase supply of personal data resource without high costs	Efficient way for government and organisations to consult citizens e.g. polls, surveys
Ability to share data for discounts & personalised products/services	Ability to access personal data services (e.g. anonymisation, blockchains) through the ecosystem without having to develop themselves	Benefit from scale effects when introducing new data services e.g. ledgering/ blockchains

Our study found that in growing and regulating the ecosystem, the enabling technology of this form of platform ecosystem must be open-sourced, so that new potential entrants to the economy do not suffer from costs of being locked in, deterring their participation in the first place. Also, the transparency of the open-sourced code allows scrutiny by third parties in terms of how the platform handles personal data. Yet, there is still a role for the market – as the technology develops, first movers can charge rents on services to be commercially profitable to just the extent that it deters new entrants from building their own. When the technology is scaled, micro transaction fees for such services could create enough profitability to power the whole ecosystem without taxing any one party. At scale, network effects could render a large portion of data exchange to be free, issued as a public good, while commercial exchanges benefit from scale economies and network effects.

The platform can expect to create a self-regulating, self-reinforcing ecosystem that avoids price-gouging, while providing enough rents to fuel the ecosystem. This attracts a variety of funding over the course of the ecosystem evolution that can include private and community investments, private equity, venture capital and public offerings.

The platform was also designed to ensure oversight, and a member-owned regulatory body was put in place to collectively decide on interoperability standards, certification of new membership, and compliance. Within such a framework, a rating system can be set to define baseline adherence, while also allowing different degrees of privacy, confidentiality, security, and trust (PCST) levels to exist. This would give a great degree of freedom to members needing to make the difficult trade-offs between cost and compliance, as well as spurring innovation and growth within a peer-defined regulatory environment.

CONCLUSION

Our study presents the development of a personal data platform, to emerge a primary market for personal data. The platform was designed with services to encourage interaction and exchanges for participants and for the network to expand. Designing for interactions led to a set of design principles that are institutionalised and legitimise new practices in the network. New institutions associated with the new platform would then emerge to become an institutionalised solution.

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