



Engineering a Market for Personal Data: The Hub-of-All-Things (HAT)
Economic Model of the Multi-Sided Market Platform and Ecosystem
Briefing Paper 2



RCUK Digital Economy HAT Project
<http://hubofallthings.org>

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Engineering a Market for Personal Data: The Hub-Of-All-Things (HAT) Economic Model of the Multi-Sided Market Platform and Ecosystem

The objective of the HAT is to engineer a multi-sided market/platform for personal data. Multi-sided platforms¹ (MSPs) are technologies, products or services that enable direct interactions between two or more groups of participants. Notable MSPs are Alibaba.com and eBay that enable transactions between buyers and sellers; Facebook for interactions between individuals, advertisers, content builders and game applications; Apple's iPhone and operating system for transactions between application developers and Apple users; Google's Android operating system (mobile manufacturers, application developers and users); and gaming consoles such as Sony's PlayStation and Microsoft's Xbox enabling interactions and transactions between game developers and users. Even physical spaces can be MSPs, such as retail malls enabling transactions between consumers and shops. Successful MSPs provide lower coordination, search and transaction costs for participants and therefore enable economic growth.

This briefing paper presents the strategic decisions to engineer the HAT as a multi-sided market platform (Hagiu 2013), and explain its associated economic model and participants in the HAT ecosystem.

The HAT in Brief

The HAT is the first-ever personal data platform (HATPDP) created to hold individuals' own data and allow them to use their own data which they can acquire from internet-connected objects or services. The data acquired is then transformed by the HATPDP to enable the individual to contextualise their own data, making it meaningful and useful for decision-making. With that data, individuals can buy apps so that they can analyse, view, trade or make important decisions based on their own data for a smarter and more effective life.

The HAT is therefore a fully scalable personal data platform for firms to offer individuals services for their data in a scalable way, and yet allow individuals to personalise it to their own needs for better decisions in their lives. Most importantly, the HAT and its transformed data is owned by the individual.

¹ For a glossary of terms and roles, please refer to the end of the document.

To understand more about the HAT, view the HAT video (<http://hubofallthings.org/>) and the HAT presentation Prezi (http://prezi.com/uuyigtukrgvj/?utm_campaign=share&utm_medium=copy&rc=ex0share).

The HAT as a Multi-Sided Market Industry Platform for the INDIVIDUAL

The HAT is a unique proposition of an ‘industry-type’ platform, but for an INDIVIDUAL.

“Industry platforms are products, services or technologies that are developed by one or several firms, and which serve as foundations upon which other firms can build complementary products, services or technologies. Building on these platforms, a large number of firms and developers would loosely assembled in what are sometimes called industrial ecosystems, develop complementary technologies, products, or services (Gawer, 2012, p.12).

HAT is an ‘industry’-type platform developed by the HAT project to be owned and controlled by individuals. This is in contrast to normal industry platforms owned by firms. In this case, since the individual owns the platform, platform rules although set by the HAT project as part of its development, can be customised by individuals in a way that is still scalable. Individuals therefore engage with firms and invite them to participate on their platforms. For firms, the HAT platform allows them to (1) build smart HAT-ready devices and services that individuals can control and acquire data onto their HAT; (2) build smart applications for individuals to make use of their data; (3) request for contextualised personal data to sell personalised products and services; and/or (4) better understand consumer consumption and experience. For individuals, the HAT platforms allows individuals to (1) share and trade data amongst themselves and with firms; (2) have a privacy-preserving data repository to store and track their data; (3) create meaning from personal data for better planning; and (4) use personal data for smarter buying and living decisions. The HAT technology platform created by the HAT project (i.e. termed as the HAT Personal Data Platform or HATPDP) therefore plays an intermediary role between the individuals and firms (two or more sides of the platform) for facilitating their interactions and transactions, but it is controlled and owned by individuals themselves with a set of platform rules with which individuals can engage with firms. Consequently, even a single individual's personalised engagement with firms on the HATPDP, based on the individual's unique data, is still fully scalable because of the standardised and yet customisable platform rules, enabling a ‘market-of-one’ to emerge.

Why a Multi-Sided Market Platform?

In order to understand multi-sided markets, we will introduce the notion of network externalities. In economics, the classic approach to network externality stresses that when new customers join the network, it adds value to the existing set of customers (e.g., Katz and Shapiro 1985). A typical example would be a telephone. The more people are

connected with a telephone, the more value is attached to having a telephone. In a single-sided market such as one supplying telephones to customers, the network externality is on

the customer side i.e. customers benefit from having more people connected through telephone. The provider could internalise that benefit by selling more telephones. For the multi-sided market however, a positive externality could come from both sides of the market. For example, the more developers creating apps on smartphones the better it is for customers, as customers would have wider choices of apps which in turn is good for developers because the market for their apps expands. Thus in MSPs, both the providers and consumers value growth in their own markets, but this is usually mediated by a third participant who would provide the tools to support both sides (providers and end users) of the market to allow them to expand, and cross-network externalities are gained. Typically, such third participants are 'platform' intermediaries who internalise the cross-side network externalities for the benefit of the platform. The HAT Personal Data Platform is developed to be such a platform. (Parker and Van Alstyne, 2005).

To design the HAT as a multi-sided market platform, we need to be aware of (1) the fundamental functions they perform; (2) what are the relevant platform "sides" (or constituents); and (3) which activities should the platform provide for those constituents (Hagiu, 2007, p.3). To become a multi-sided market platform, there is a requirement for exhibiting indirect network effects that is absolutely essential in order to have a true MSP and not a single-sided platform (which usually exhibits economies of scale) (Hagiu, 2007, p.3). Members of one side are more likely to get on board the MSP when more members of another side do so (Hagiu, 2007, p.3). In other words, there are positive indirect network effects among the groups in MSPs (Hagiu, 2007, p.3).

Strategic Decisions

The following articulates the strategic decisions of the HAT ecosystem as multiple multi-sided markets (Boudreau and Andrei Hagiu, 2008; Hagiu 2013).

The number of sides to bring on board

To ensure that personal data has value, the following sides are brought on board:

Inbound data suppliers (HAT-ready devices and services) - These are (a) firms that produce internet-connected objects (ICOs) that can supply individuals with their personal data, such as Fitbit (measurement of steps) and air quality and environment sensors like CubeSensor (home air quality and temperature); or (b) firms that take on individuals' own data to provide a service e.g. Google Calendar, social media platforms. Inbound data suppliers provide individuals with their raw personal data that can be transformed by the HAT (see briefing paper 1) and contextualised by the individual.

HAT users- These are individuals who would buy ICOs and services and acquire the data for transformation and contextualisation on the HAT.

Outbound data operators (HAT developers and HAT service providers) - These are application developers who (1) sell applications to HAT users to use by applying their own

HAT data [explanation of a scenario]; (2) inbound data suppliers of ICOs who want to create a front-end application to exchange HAT data for services [explanation of a scenario]; or (3) firms who wish to buy data relating to HAT users' consumption and experience of their products, such as consumer goods manufacturers who want to better understand how users use home products [explanation of a scenario].

Third-party dataset providers (HAT service providers) - These are open data providers (e.g. government, transport authority, weather etc.) whose data is useful to be integrated with personal data for innovative and personalised services (e.g. the weather enroute to your destination); or those who control and update lists (e.g. supply chain SKU data of goods and their ingredients or characteristics) that enrich the platform through look-up tables of information and better understanding of data.

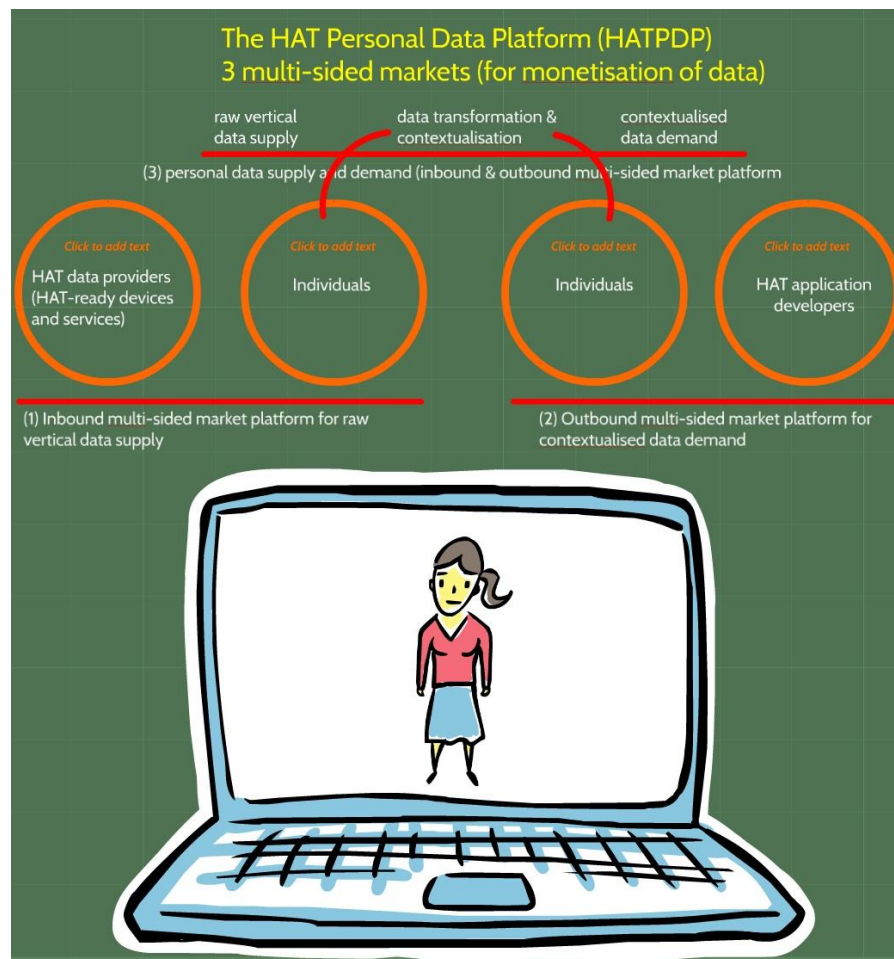
HAT Personal Data Platform providers - These are organisations that serve to host the individual's HATs and provide the platform for HAT developers and HAT service providers to build applications based on personal data.

However, the structure of the multi-sided markets have been designed not to be 'flat' (i.e. one platform) but nested and hierarchical. We explain the complexity of the market platform designs.

1. The HAT is not one platform with many HAT users (e.g. the way Facebook, eBay etc. are). Rather, as explained above, each user's HATPDP is a mini-industry platform and server in itself and each user therefore control their HATPDP. That means that each HAT user has the ability not merely to store but also to run computations on its server. Hence, as a platform, the HATPDP would also have multiple sides. In this case, the HATPDP has 3 multi-sided markets:
 - a. The first multi-sided market is the inbound data supply multi-sided market. Within this market, HAT-ready devices and services are the supplier of raw vertical-type (sector driven) data and individuals are the buyers. By acquiring these devices and services, individuals ensure they have a supply of data.
 - b. The second multi-sided market is the outbound data supply multi-sided market. Within this market, HAT service providers provide applications to operate, buy, rent, or sell HAT data from the user. Individuals in this market become the supplier of data.
 - c. By designing the above 2 multi-sided markets, a third multi-sided market emerges at the higher level, consisting of demand for transformed and contextualised data on one side and raw vertical data on the other. This third multi-sided market emerging from the first two is essentially the market that monetises Internet-of-Things data (the raw vertical data) through a

process of transformation and contextualisation that traverses the individual and allows the individual to set data rules on privacy. This third multi-sided market platform is emergent from the other two platforms and cannot directly be engineered.

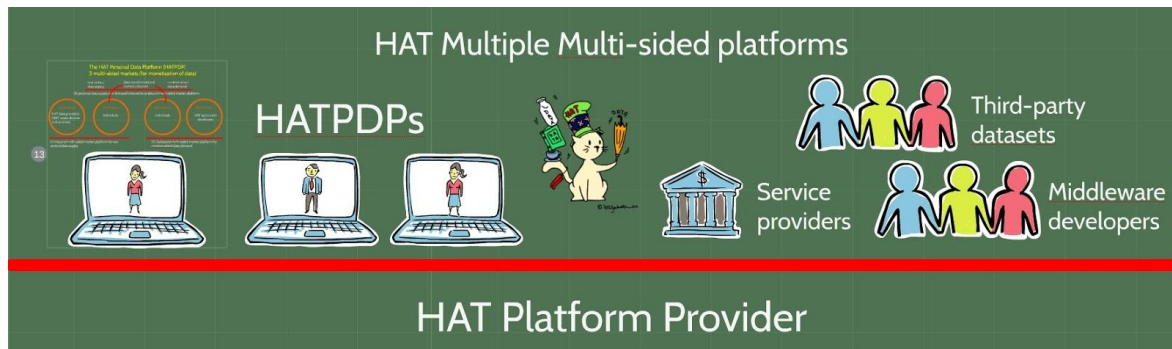
The following is a diagram of the 3 multi-sided markets of the HAT personal data platform:



2. The provision of a HATPDP to users is in itself another platform, one provided by a HAT Platform Provider (HPP). The HPP is a host platform of HATPDPs. However, instead of being the only service provider (i.e. a single-sided market) to HATPDPs, the HAT platform becomes a multi-sided market platform as well, working with a community of application developers, dataset providers and middleware service providers to serve HATPDPs. This strategic decision of designing a HPP as a multi-sided market rather than single-sided is important because being a single sided market will not allow an ecosystem of innovation to flourish. The diversity of HAT data and its uses are so high that a multi-sided market platform of multiple

players is the only way to ensure a variety of services and solutions match with the variety of data available on the HATPDP.

A diagram of the HPP platform is illustrated below:



The Need for a Regulatory Role

Platform leaders tend to strategically facilitate and stimulate complementary third-party innovation through the careful and coherent management of their ecosystem relationships as well as decisions on design and intellectual property (Gawer and Cusumano, 2002; Iansiti and Levien, 2004). It is therefore essential that the entire eco-system of multiple multi-sided platforms is carefully coordinated and managed so that (1) the right behaviours are in place; and (2) the right incentives are in place to ensure greater innovation, high efficiency through self-regulation while meeting the diverse interests of the ecosystem participants.

For the HAT ecosystem to thrive, there must exist a regulatory role in the HAT ecosystem. This could be achieved through 'applying a variety of contractual, technical and informational instruments' (Boudreau and Hagui, 2008). The purpose of regulation is to enhance two basic functions that MSPs can perform: (1) reducing search cost, incurred before transactions: It is the cost incurred for determining the best 'trading partners' (Hagui, 2007, p5); (2) reducing sharing cost incurred during transactions, it is the cost common to all transactions, the 'shared' or 'duplicate cost' (Hagui, 2007, p.6). The MSPs' performance relies on (1) economies of scale and (2) indirect network effect of the platform (Hagui, 2007).

In the design of the HAT multi-sided market platform for personal data, the issue of privacy, security and confidentiality and trust is paramount. Thus the platform must ensure that the following 4 critical functions have to be in place so that cross side network effects and economies of scale are realised:

1. A trust broker to ensure all sides are happy to exchange and transact given a set of transparent and mutually agreed rules (*Aiming to reduce search cost*)
2. A compliance body to ensure privacy, security, confidentiality is preserved based on mutually agreed practices (*Aiming to reduce search cost*)

3. A regulatory body to ensure incentives are designed to increase participation from all sides (*aiming to enhance the indirect network effect*)
4. A financial clearing body to ensure all parties are suitably rewarded for efforts to grow the platform (*reducing the shared cost*). For example, payment systems are classic examples of shared cost-reducing MSPs. They provide an infrastructure which reduces transaction costs between buyers and sellers and in doing so, eliminate the need for barter. (Hagiu, 2007, p.6)

To ensure the 4 functions are carried out, it is proposed that the HAT project team will evolve into a not-for-profit foundation to implement the processes necessary to achieve them in June 2015.

Platform Design, Incentives and Revenue Structures: Emerging the Ecosystem and its Economic Model

It is suggested that one character of the industry platform is that the end use of end-product or service should not pre-determined. This leads to another design rule for industry platforms: the interfaces around the platform must allow plugging-in of complements, as well as innovation on" (Gawer, 2010, p.14). One concern that needs to be addressed is 'how incentives (for third-parties) to innovate can be embedded in the design of platforms' (Gawer, 2010, p.14).

Consequently, the following design decisions on pricing and revenue structures were made of the HAT platform and its ecosystem:

The HAT project/foundation will provide the HATPDP technology developed by the project to HAT platform providers (HPPs). In turn, the HPPs provide the HATPDP to users and create new functionalities and 'plugins' from their platform community to build apps on their platform. The HPPs take revenue from the apps sold to the end user on a revenue-sharing basis with their community of developers. In addition, additional storage of data on the HAT may be charged above a certain reasonable level and other revenue models such as data for payments could be possible. HAT apps bought by a HAT user on another HAT platform could also potentially be provided with a portion of the revenue.

The HAT Economic Model

The economic model (what you get for what you give) between the platform sides is articulated in the table below. Each cell depicts **what the row entity gets from the column entity**.

	<i>Inbound data suppliers (HAT-ready devices and services)</i>	<i>HAT users</i>	<i>Outbound data operators (HAT applications)</i>	<i>Third-party dataset providers (HAT service providers)</i>	<i>HAT Personal Data Platform providers (HPP)</i>	<i>Middleware HAT service providers</i>
<i>Inbound data suppliers (HAT-ready devices and services) (e.g. for devices like fitbit, smart meters or for services like calendar, social media, telecoms, health service, banks)</i>		<p>What they get: Revenue from the purchase of the device. Wider network of users using their devices if their devices and services are HAT-ready</p> <p>What they give: Device and Data from the device through their open APIs</p>	<p>What they get: Revenue from end-to-end value proposition to HAT users e.g. a vacuum cleaner that gives data to the HAT and an outbound HAT application to compare usage with other vacuum cleaners</p> <p>What they give: Aggregate data across the population of devices</p>	<p>What they get: Lookup tables for items or other data that could be integrated with their data onto the HAT</p> <p>What they give: Aggregate data across the population of devices</p>	<p>What they get: Wider network of users using their devices if their devices and services are HAT-ready</p> <p>What they give: Open API data</p>	No direct interactions (only through the HPP)

HAT users	<p>What they get: A chance to acquire their data onto their own HAT</p> <p>What they give: Payment for the purchase of devices or services</p>		<p>What they get: A diverse set of applications to choose from to analyse, use, rent or sell their data</p> <p>What they give: Payment for applications</p>	<p>What they get: No direct interaction (only through HAT applications)</p>	<p>What they get: A HATPDP to store their own data and contextualise it for their own use; ability to buying services for their data</p> <p>What they give: Payment to buy apps; Payment from increasing storage of data</p>	No direct interactions (only through HPP)
Outbound data operators (HAT developers and HAT service providers)	<p>What they get: Revenues from building applications through collaborating with device manufacturers to help them develop outbound HAT applications</p> <p>What they give: New applications on the HAT for</p>	<p>What they get: Payment from selling applications; opportunity to buy data from customers in a scalable way to understand consumption and experience of their own products in their own sector that they can sell on to manufacturers</p>		<p>What they get: Revenues from high quality applications from integrating third party datasets into their own applications (e.g. integrating transport and weather dataset into a scheduling application)</p> <p>What they</p>	<p>What they get: Access to HAT users to buy their applications revenues from sale of applications middleware support from the platform</p> <p>What they give: Share of revenues from applications to use platform</p>	<p>What they get: Functionality to build their HAT application</p> <p>What they give: Sharing revenues received with the middleware functionality</p>

	manufacturers	What they give: New applications on the HAT		give: Applications that integrate HAT personal data and third-party data	and middleware functionalities (possible freemium model)	
Third-party dataset providers (HAT service providers)	What they get: Shared revenues wider network of devices and service using their data What they give: Lookup tables for items or other data that could be integrated with their data onto the HAT	What they get: No direct interaction (only through HAT applications)	What they get: Shared revenues from applications that integrate HAT personal data and third-party data What they give: Datasets for integration		What they get: Wider usage of their data and share of revenues when data is used What they give: Datasets for integration on the HAT	What they get: Wider usage of their data and share of revenues when data is used What they give: Datasets for integration on the HAT
HAT Personal Data Platform providers	What they get: Open API data from HAT-ready devices and services What they give: Wider network of	What they get: Revenues when HAT users buy apps revenues from increasing storage of data by HAT users	What they get: Wider network of developers using the HPP platform to build applications; payment to use platform and middleware	What they get: Datasets for integration on the HAT greater network; effects of a larger developer community when more		

	users if their devices and services are HAT-ready	What they give: A HATPDP to store users' own data and contextualise it for their own use; ability to buy services for their data	functionalities (possible freemium model) What they give: Access to HAT users to buy their applications; revenues from sale of applications; middleware support from the platform	datasets are integrated What they give: Wider usage of data and share of revenues when data is used		
Middleware HAT service providers	No direct interactions (only through the HPP)	No direct interactions (only through HPP)	What they get: Sharing revenues received when HAT applications use the middleware What they give: Functionality to build HAT application	What they get: Datasets to create additional tools and functionality on the HAT What they give: Revenues from new functionality integrated with datasets to sell to HAT application developers	What they get: Shared revenues from the HPP when functionalities/tools are used What they give: Tools and functionalities	

Governance Rules

In terms of governance, there are four levers in the design of platforms (Gawer and Cusumano, 2002, 8-9). In the case of the HAT, platform leadership is shared between HPPs and the HAT project/foundation. So that a trust framework can be upheld, the HAT project/foundation will have a compliance and regulatory role for data and the economic system, while HPPs will have a market role. Each of the four levers in the design of the HAT platform is presented below:

- (1) First, the choice of what activities to perform inhouse vs. what to leave to other firms. This decision is about whether the platform leader should make at least some of its own complements in-house.

Given that there will be multiple HPPs, competition between them will ensure that the market is efficient in terms of what the HPP should provide and what should be provided by other firms on the platform.

- (2) The second lever is product technology (architecture, interface and intellectual property): what functionality or features to include in the platform, whether the platform should be modular, and to what degree the platform interfaces should be open to outside complementors and at what price.

The roles played by the MSP owners could include assuring technical development and coordination among contributors to an MSP ecosystem and designing technical architecture that frames interactions. This can be achieved through establishing technical standards and interfaces, rules and procedures, defining the division of tasks, providing support and documentation, sharing information and so on and so forth' (Bourdeau and Hagiu, 2008, p.166). This role would be undertaken by the HPP, as they build their community of participants on the platform.

- (3) The third lever covers external relationships with complementors: the process by which the platform leader manages complementors and encourages them to contribute to a vibrant ecosystem.

This is again the role of the HPP to ensure a vibrant eco-system. The HAT project/foundation will support this through communications and coordination between HPPs.

- (4) The fourth lever is internal organisation: how and to what extent platform leaders should use their organisational structure and internal processes to give assurances to external complementors that they are genuinely working for the overall good of the ecosystem. This last lever often requires the platform leader to create a neutral group inside the company, with no direct profit-and-loss responsibility, as well as a Chinese wall between the platform developers and other groups that are potentially competing with their own complementary products or services.

As this is a platform on personal data, the fourth lever is critical in the health and growth of the ecosystem. As such, the HAT project/foundation takes on the following processes so that trust is maintained within the ecosystem.

The HAT Project/Foundation would take on the following roles:

1. Set up a Code of Practice for all roles directly involved in the management of personal data;
2. Validate all HAT applications to ensure they are compliant to the HAT Code of Practice;
3. Maintain store catalogue for all HATPDP installations so that all HATs have access to all applications developed on all HPPs so that network effects are maximised;
4. Provide a payment gateway for inter-platform payments so that there is incentive for participants on one HAT platform to buy/sell data and applications from another HAT platform;
5. Manage inbound/outbound APIs so that data flows are consistent, and seen to be consistent with the Code of Practice;
6. Manage the universal HAT unique ID database so that HAT users can move between platforms (avoiding Hostage and captive situations);
7. Install and update the HAT personal data platform (HATPDP) for the HAT platform provider so that all versions of the HATPDP is the same across all platform providers; and
8. Advise and approve economic and business models, pricing structures and charge policies so that the right incentives are in place for the right behaviours in the interest of the overall ecosystem.

Taken together and dealt with in a coherent manner, the four levers offer a template for sustaining a position of platform leadership.

Glossary of Terms

The HAT	A personal data platform developed by the <i>HAT project</i> that allows a HAT user to acquire, store, transform, view, sell, rent, trade and use his or her personal data
HAT-ready Device	A device that is able to send and/or receive data to/from the HAT in a way that is compliant to <i>HAT CoP</i> and certified by the <i>HAT project</i>
HAT-ready Service	A service that is able to send and/or receive data to/from the HAT in a way that is compliant to <i>HAT CoP</i> and certified by the <i>HAT project</i>
HAT Service	A service that runs on the HAT at all levels (platform, user, middleware etc.)
HAT User	An individual who owns and uses HAT data and integrates data from HAT-ready devices and services
HAT Data	Data from HAT-ready devices and services which the individual has access to that is acquired into the user's own HAT
HAT Event Data	A set of HAT data that is brought together by the HAT user for a user-defined 'event'. HAT event data could be tracked by the user over time or shared, sold, rented, traded through the D3 system
HATPDP Provider (HPP)	An organisation that hosts users' HATs and supports a community of HAT developers by developing HAT services that improve the HATPDP capabilities
HAT Developers	Individuals who create HAT services who could be working for HAT service providers
HAT Service Providers	Organisations who provide a HAT service on the HATPDP
HAT Participants	HAT developers, HPPs, HAT users, HAT service providers

HAT CoP	A set of practices that all HAT participants subscribe to
The D3 System	The Direct Data Debit (D3) system on the HAT that enables the access of personal data on an individual's HAT
HAT Project/Foundation	The £1.2m RCUK Digital Economy-funded project of 6 universities led by WMG, University of Warwick that would evolve into an open-sourced, community supported foundation

Roles on the HAT Ecosystem

HAT User

Description: An individual who owns and uses HAT data and integrates data from their HAT-ready devices and services

Functions:

1. Users register with a HATPDP Provider for a HAT
2. Users are given a unique HAT ID
3. Users authenticate their identity and access to their HATPDP Provider
4. Users acquire data from HAT device(s) and service(s) onto their HAT
5. User personalises their HAT
6. Users lookup and check personal data on their HAT
7. User create an event and decide what HAT data is relevant in the event
8. User track their HAT event data
9. User export their HAT event data for sharing or to be used, bought or rented by third parties through the D3 system
10. User can see their list of D3s and transaction history
11. User can control their D3 system rules such as cancelling or modifying a D3

HAT Project/Foundation

Description: The £1.2m RCUK Digital Economy-funded project of 6 universities led by WMG, University of Warwick that would evolve into an open-sourced, community supported foundation

Functions:

1. Appoints and licenses the HATPDP hosting by HPPs
2. Supports HPPs with technical, economic and business advice
3. Advises on how devices and services can be HAT-ready
4. Reviews requests for HAT certification of HAT-ready devices and services
5. Certifies if devices and services are HAT-ready
6. Enables the download of HATPDP and its versions for HAT users by HATPDP providers
7. Maintains and updates the HATPDP
8. Maintains and updates HAT inbound APIs of all HATPDPs
9. Maintains and updates HAT outbound APIs of all HATPDPs
10. Maintains and updates HAT store catalogue of all HAT-ready devices and services
11. Manages the Framework of Accreditation on HAT service providers
12. Manages the HAT unique ID database of HAT users

13. Advises on economic and business models of the HAT
14. Regulates financial and economic conditions within the HAT ecosystem
15. Approve pricing structures of HAT applications and charge policies of HATPDP providers

HAT Developer

Description: Developers who create HAT services

Functions

1. Develops HAT services that enable the sharing, buying, renting or operating of user applications on HAT data
2. Maintains working version of the HAT services
3. Provides regular software patches and updates to maintain the HAT services
4. Notifies the HATPDP provider when the HAT services are changed or deleted from use

HATPDP Provider (HPP)

Description: A platform provider that hosts users' HATs and supports a community of HAT developers by developing middleware capabilities

Functions:

1. Defines the level that the HPP will operate the HAT database and service for a HAT user
2. Provides users with a HAT environment.
3. Ensures security of data on behalf of the HAT user
4. Ensures confidentiality of data through access control
5. Validates the service rules for event creation and data debit generation with the compliance of the user
6. Validates the data debit privacy rules
7. Validates data debit usage rules
8. Enforces the service rules and usage rules to enforce the privacy requirement

References

- Boudreau, K.J. & Hagiu A. (2008) Platform rules: Multi-sided platforms as regulators. Available at SSRN 1269966
- Gawer, A. & Cusumano, M.A. (2002). Introduction: Platform leadership and complementary innovation, in Gawer, A. and Cusumano, M.A. (eds) *Platform leadership: How Intel, Microsoft, and Cisco drive industry innovation*. Boston, MA: Harvard Business School Press.
- Gawer, A. (2010) Towards a general theory of technological platforms. Paper to be presented at the Summer Conference 2010 on "*Opening Up Innovation: Strategy, Organization and Technology*" at Imperial College London Business School, June 16 - 18
- Gawer, A. & Henderson, R. (2007) Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel, *Journal of Economics & Management Strategy*, 16(1), Spring 2007, 1–3
- Hagiu, A. (2007) Multi-sided Platforms: From Micro-foundations to Design and Expansion Strategies, Harvard Business School Strategy Unit, Working Paper
- Hagiu, A. & Wright, J. (2013) Marketplace or Reseller? *Harvard Business School Working Paper*, No. 13-092, May
- Iansiti, M. & Levien, R. (2004) The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy and Innovation, *Harvard Business School Press, Boston*
- Katz, M. L. & Shapiro, C. (1985) Network Externalities, Competition, and Compatibility. *American Economic Review*, 75(3) 424–440.
- Parker, G.G. & Van Alstyne, M.W. (2005) Two-sided Network Effects: A Theory of Information Product Design. *Management Science* 51(10), October, 1494-1504

Hub-of-all-Things (HAT) Research Team (incorporating the HARRIET team)

The Investigators

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