Internet of Things convergence

SUMMARY OF PREPARATORY STUDIES
OCTOBER 2012

Key Findings

- **Internet-connected ecosystems matter**

- **The data often exists, but may not be readily available**

- **Data trust and privacy must be managed**

- **Interoperability and sharing data through information hubs opens up the market**

- **We must understand the business case and risks more clearly**

- **Demonstrators allow value propositions to be proved**

- **The ecosystem is immature**

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Introduction

The Internet of Things is already with us – an internet-driven revolution which brings together a growing number of web-enabled devices that can network and communicate with each other and with other internet-enabled objects in daily use.

The number of connected objects is estimated to reach 50 billion by 2020, and the potential added value of services using the Internet of Things is likely to reach hundreds of billions of pounds a year, with new business models, applications and services appearing across different sectors of the economy.

This is likely to have such a radical impact on business and the way we live that the Technology Strategy Board's Digital strategy identifies the Internet of Things (IoT) as a major focus for investment, helping the UK to gain an early advantage in its adoption. Just as importantly, UK business needs to be at the forefront in developing the associated applications and services.

To fully realise the potential of the IoT it is crucial that these applications and services are part of an open 'ecosystem' which operates within and across different sectors. Last year, we announced funding for 10 preparatory studies to develop scenarios and strategies which would point the way more clearly towards an open application and services marketplace for the Internet of Things[1].

This report explains the scope of these studies and the approach taken, together with the findings.

The studies ran for four months from March 2012, looking at real-world scenarios in a variety of sectors, with particular emphasis on the following:

- the nature of the opportunity and the barriers to an IoT ecosystem
- the applications and services that could be developed, with business models and cost-benefit analyses

'For the potential of the Internet of Things to be fully realised, there is a deep need to think across industry sectors, while developing compelling use cases. This is what we aimed to achieve with this preparatory investment'

Dr. Maurizio Pilu
Technology Strategy Board

- the challenges in improving access to data from 'things' and how they could be overcome
- practical approaches to overcoming barriers and realising the opportunities
- suggestions for demonstration facilities to support experimentation.

For some personal perspectives on the IoT from those involved in the work, take a look at this short video **http://vimeo.com/44727733.**

The studies

The table opposite provides an overview of each study, showing the title, lead company and collaborators together with a brief summary of the aims. The projects explored applications and services in sectors including transport, logistics, the environment, energy, health and social care, cities, the home, retail and brewing.

Each of the projects also produced a comprehensive report which can be found at **https://connect.innovateuk.org/web/iot-convergence-preparatory-studies-2012**

Working together

To ensure that the studies could address the complexity of real life situations, the project teams involved substantial numbers of stakeholders in interviews, workshops and focus groups. Potential IoT users with understanding of use-case scenarios were at the heart of the work.

To maximise the initiative's long-term impact, it sought to identify and explore common issues between sectors and applications. To this end, the 10 study teams took part in three collaborative workshops (facilitated by 100% Open [**www.100open.com]**).

1 The original competition brief can be found at http://www.innovateuk.org/_assets/0511/tsb_internetofthingsconvergencecompflyert11-043_final_dh.pdf

Study Title	Lead Company	Collaborators	Summary of aims
Intelligent city transportation - infrastructure (ICT-i)	AIMES Grid Services	Merseyside Transport Authority, Placr Ltd, Avanti	Examine the revenue models needed to ensure the commercial viability of an IoT ecosystem in transport/ traffic information; the interoperability of data sets and of data stores; and the requirements for high availability infrastructure to deliver reliable services to end users.
My health trainer	Globosense Ltd	ThingConnect, Medical Research Council, Onzo	Develop a business case for a free e-health and fitness web/mobile application to improve wellbeing; in exchange, analytics derived from user data are sold to online retailers for marketing activities.
Cross domain IoT broker	Cambridge Wireless Ltd	University of Bath, BathCube, Docobo, SciSys, Secure Controls, Personal Information Broker-Development Ltd	Examine how data held individually in different sectors can be securely shared to minimise the effects of a 'severe weather episode' on individuals, utilities, transport and the wider UK economy.
IoT-enabled converged and open services for transport and logistics	BT plc	IT Innovation, Ctrl-Shift, Highway Agency, IsoTrak, Milton Keynes Council	Analyse the commercial, technological and legal requirements for an environment where smart transport applications and business process improvement can be generated by exploiting a critical mass of diverse, real-time and historical data.
Consumer convergent retail (CCR)	Focus Innovation	Good Stuff Communication, SimplyTap, I2Media Research	Explore retail environments, stores and shopping centres in order to highlight opportunities and pitfalls for the retail sector in terms of the most promising consumer use cases.
City of Things	Swirrl IT Ltd	Manchester Digital Laboratory, LittleStar, University of Aberdeen, Manchester Business School, The Customer's Voice, Manchester Digital Development Agency (MDDA)	Look at use cases and business models to improve allocation of scarce public sector resources and also the potential for more efficient, cleaner, safer cities through better exploitation of the available information.
Smart streets	InTouch Ltd	Carillion, Lancaster University, Redcar and Cleveland Borough Council	Explore the potential for connecting highways assets such as street furniture, road surfaces and gullies to the Internet of Things in order to find radically new ways of maintaining highways infrastructure.
How can smart home data and systems improve assisted living services	Wattbox Ltd	Alertme, Tortrix, Orbit Housing, Coventry University HDTI	Investigate how smart home technology can link between home energy management, home security and telecare and lifestyle monitoring services.
Value chain analysis of the internet of things for the brewing industry (VIB)	IntelliTap Ltd	University of Nottingham, Everards Breweries, Nottingham Business School, Peter Scarks Designs	Explore the potential for the Internet of Things to align data and service value chains within the UK brewing industry, with a particular focus on cask recovery.
Internet of Things for housing, health and care	Housing 21	Cranfield University, IBM	Develop a strategy to access and share information about relevant 'things' regardless of location or repository and deliver it to the right people at the right place and time in order to directly benefit individuals' health and wellbeing.

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The project teams were able to see commonality of issues across very diverse sectors and applications, and to understand them from different perspectives, such as technical, social, ethical and legal.

In June 2012 the workshops culminated in an event at which the project collaborators, leaders, journalists and policy makers came together to showcase the work and to debate and explore findings. The emergent nature Internet of Things meant it was important to share the collaborative activity as widely as possible. A number of online channels[2] were used to support dissemination and discussion around the workshops – you will be able to read about these activities and see outputs from all the work on **https://connect.innovateuk.org/web/iot-convergence-preparatory-studies-2012.**

Findings

One of the aims of the studies was to explore in depth the common barriers and challenges to developing an Internet of Things ecosystem as seen from multiple sectors and application areas. This section summarises the key findings. The extended reports capture the full scale of the richness, complexity and interconnectedness of these and many other issues.

> ■ 'This collaborative but focused activity is quite a productive way of getting ideas on the table'
>
> ■ 'I come strongly from a user perspective; it was interesting coming here learning more about the developer and the policy maker side of things'
>
> ■ 'You see a great deal of commonality in the problems we're all trying to address'
>
> **From the showcase event 27 June 2012.**
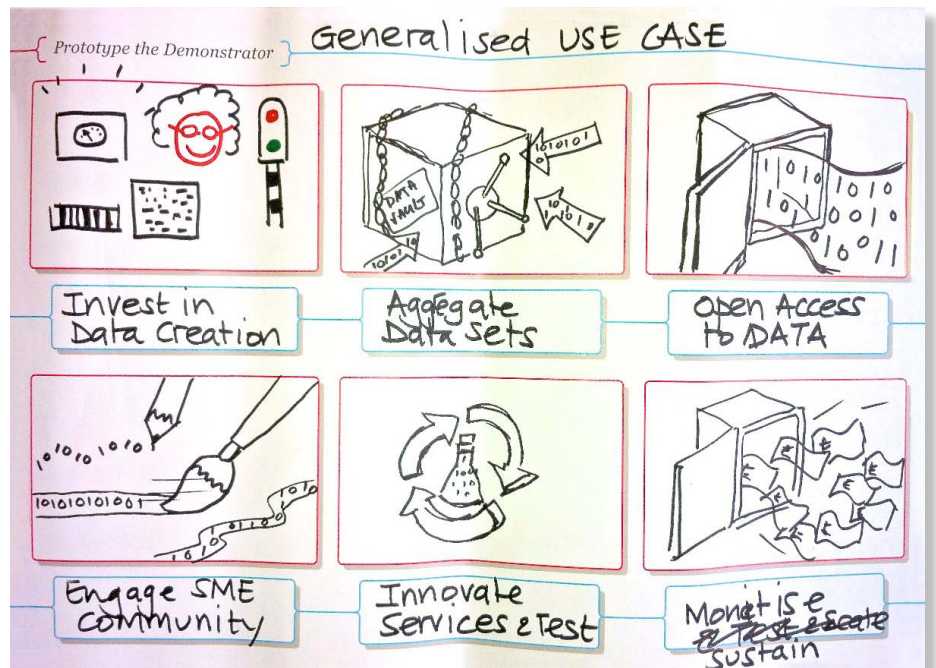
Internet-connected ecosystems matter

Much of the existing work in connecting objects, people and data is done in closed, proprietary environments. The projects found that they needed to develop 'Internet-style' open ecosystems to create the disruptive landscape in which they could unlock substantial opportunities. However, value could only be generated by addressing real problems with solutions which someone would invest in or pay for.

The data often exists, but may not be readily available

There are few incentives to make data available, owing to a combination of actual or perceived liabilities, unclear returns and costs. For example the Smart Streets study (led by In Touch) highlighted how much of UK infrastructure is instrumented or monitored in some way, but also that this data is often held in closed systems or is discarded quickly after it is gathered. It demonstrated the importance of developing solutions to allow data owners to retain a level of control, to mitigate their risks and to identify data sharing and reward mechanisms.

Data trust and privacy must be managed

Much of the data surrounding the Internet of Things has personal implications, either because it can be traced to individuals or because it may have an impact on them. For instance, Consumer Convergent Retail (CCR), led by Focus Innovation, saw the person as a data-rich object within the Internet of Things and explored the motivation for individuals to release personal and social data in a managed way through a personally owned 'data-passport'.

The Globosense-led MyHealthTrainer study suggested a model where users generate and analyse their own wellbeing data. The barriers to obtaining personal data are thus much lower.

> 'Within the business sectors represented in the project there is significant additional value obtainable from combining IoT data between sectors/chains whereas normal behaviour for actors in these chains is to keep this data for internal use'
>
> **Cross Domain IoT Broker Study**

Interoperability and sharing data through information hubs opens up the market

Many organisations saw difficulty in sharing data and identified the importance of standards and interoperability at all levels, particularly around data formats. The concept of an information hub or broker was explored in a number of studies.

The IoT Enabled Converged and Open Services for Transport and Logistics study (led by BT) proposed the development of an open information hub approach to help generate critical mass – allowing more parties to discover and use data sets and lowering the entry barrier for new entrants. Smart Streets proposed that outsourced highways maintenance contracts (which are ultimately subject to government control) should impose conditions relating to IoT standards on sub-contractors bidding for work to accelerate IoT convergence. Swirrl IT through the City of Things proposes a Standard Information Sharing Label with specific agreed fields.

We must understand the business case and risks more clearly

Many of the studies identified compelling use cases. However, the business cases and risks, technological and non-technological, are often poorly understood. The Value Chain Analysis of the Internet of Things for the Brewing Industry (VIB) study

for instance identified lack of first mover advantage as a key barrier, together with lack of awareness of IoT. In this instance, they recommended a proof of concept pilot trial to demonstrate cost savings, supported by a series of workshops and events with the brewing trade to increase understanding. Enabling businesses to experiment and innovate with the use cases and technologies without taking too many risks is important at this stage. Demonstrators, sandpits and similar facilities could help here.

> 'The many-to-many nature of the hub makes it attractive to the information providers and consumers. It increases the number of parties who are able to discover and use datasets, generating additional value for information providers and it increases the range of data available to information consumers'
>
> **Enabled Converged and Open Services for Transport and Logistics study**

Demonstrators allow value propositions to be proved

Emerging use cases can be better demonstrated in well-defined contexts or clusters with enough scale to be representative while retaining a level of ownership and control for rapid experimentation with the key stakeholders. For example, The Intelligent City Transportation study led by AIMES proposed a local campus concept that would align the many stakeholders with a clear political structure – important in opening access to the necessary data.

The ecosystem is immature

The Internet of Things ecosystem is still immature. During the workshops, the project teams came up with a useful way of thinking about the development of an ecosystem. The diagram on page 4 came out of one the workshop sessions that brought together themes related to the development of an IoT ecosystem.

Next steps

These studies have been invaluable in influencing the Technology Strategy Board's follow-on programme of activities. In particular, the recommendations have informed the scope of the £4m October 2012 IoT Ecosystem Demonstrator competition **http://www.innovateuk.org/content/competition/internet-of-things-ecosystem-demonstrator.ashx**.

The studies will also help shape future activities by the Knowledge Transfer Networks and the Internet of Things Special Interest Group, as well as other stakeholders interested in the development of the Internet of Things in the UK. They will also inform the way the Connected Digital Economy Catapult is approaching this whole subject area. **https://connect.innovateuk.org/web/connected-digital-economy/**

Further Information

More information about the studies, including the reports and other material can be found on the _connect group **https://connect.innovateuk.org/web/iot-convergence-preparatory-studies-2012**

The Technology Strategy Board's Internet of Things Special Interest Group can be found at **https://ktn.innovateuk.org/web/internet-of-things**

The Technology Strategy Board is a business-led executive non-departmental public body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve quality of life.

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