EXAMINING IoT BUSINESS MODELS
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The IoT is built on a complex ecosystem, with a host of different technology providers vying for a share of the revenue that the adoption of IoT is expected to drive. One of the toughest issues that companies developing IoT solutions face lies in choosing the right business model, or the right blend of business models to adopt.

The key to understanding today’s IoT business models, and how they will evolve lies in recognising the point at which the “value” of an IoT deployment is realised. This is true whether that value is expressed in economic terms with improved margins and lower costs, or through competitive differentiation with the ability to offer new value to customers.

There is no single canonical business model for the IoT, and implementers of IoT solutions will have to consider carefully where their product, service, or solution sits within the IoT value-chain, and how and where the consumers of their offering will derive value from it in order to determine the right business model for their proposition.

Key messages

- Value realisation lies at the heart of any business model
- There are many different potential business models
- While some business models point to a specific way of charging, some can support different charging models
- Current business models fall into two broad classes: the first is focused on improving existing processes, the second on the creation of new value
- Different models will be applied within the IoT ecosystem
- In the medium term, more traditional models will gain the most traction
- In the longer term, more exotic models will emerge
Value realisation lies at the heart of any business model

The first question that investors will ask of any proposition is “where is value realised?” In the domain of IoT this can be defined as the point at which some action is provoked. For example, the deployment of sensors that monitor the health and functioning of train doesn’t deliver any benefit at all until the information that is gathered is used to provoke some action, for example, in the form of scheduling maintenance to prevent a failure. For that action to have value it has to promise either a financial benefit to the provider of the product of service, with a reduction in the cost of unplanned maintenance or a benefit to the consumer of the product or service, such as more reliable trains.

Today the value proposition of the IoT is slightly blurred in some domains, as the “value” that is realised in some cases relates more to lifestyle or self-perception than a quantifiable monetary impact, with a Fitbit, for example. There are also secondary points of value realisation, relating to the way in which the data gathered in one context may drive the realisation of value in another. In the case of the Fitbit, the data collected could be used by the sports clothing and equipment industry to develop products and target them more effectively. In this model there are multiple routes to value – The individual consumer gains value, albeit some of it in the difficult to quantify form of self-actualisation, while the clothing manufacturer gains a commercially valuable insight into the market.

The See Sense project originally set out to develop a new generation of light for cyclists. See.Sense held two highly successful crowd-funding campaigns on Kickstarter, raising over £130,000 to develop and bring their lights to market. But See.Sense also saw an opportunity to use their technology as a means to gather data on the urban environment – data that could subsequently be used in urban planning and environmental management. By adding data collection and analysis to the proposition, See.Sense can now pursue a hybrid business model – in part built on the sale of the lighting technology and in part on the sale of the data the platform collects.

One important lesson that has been learned by many IoT projects is that these secondary points of value realisation may not be immediately evident; so projects need to be ready and able to adopt new, complimentary, business models as they evolve.

Differentiation is key to building a sustainable business

The IoT sector is fast moving, chaotic, and filled with innovation. The key to long term survival lays in the ability of IoT solution providers to create and maintain differentiation. In the medium term, the ability to bring a working solution to market quickly is a significant differentiator, alongside the ability to scale a solution from proof of concept (which may involve a few tens of nodes) to large scale deployment, which may involve many thousands.

Plainly, price competition will also play a significant factor, especially in those parts of the IoT ecosystem where commoditisation has already taken place as with microprocessors, and to a large extent, connectivity. But IoT solution providers should be careful not to engage in a land grab by offering services at low or no cost, unless they are prepared to fund their own growth over the medium to long term.

IoT solution providers need to assume that the market will expect rapid and sustained levels of innovation, and should build adaptability and extensibility into any solution that they bring to the market.
There are many different potential business models

Below we outline several core business models that might be applied to an IoT product or service.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-added feature</td>
<td>IoT functionality brings a value-added feature to an existing product</td>
<td>Facility to post data from a consumer weather-station to the web</td>
</tr>
<tr>
<td>Simple Purchase</td>
<td>The product is bought in a one-off transaction</td>
<td>Wireless doorbell</td>
</tr>
<tr>
<td>Pay Per Use</td>
<td>Where the consumer pays according to their level of use/consumption of the product</td>
<td>Rolls Royce selling “miles flown” instead of simply providing aircraft engines</td>
</tr>
<tr>
<td>Ecosystem Play</td>
<td>An ecosystem in which multiple separate devices can be linked. The ecosystem may be open (allowing anyone to attach to it) or closed (in which people have to pay to join the ecosystem)</td>
<td>Interconnected thermostat to which door sensors, smoke alarms, and CCTV cameras can be connected</td>
</tr>
<tr>
<td>Secondary revenue stream</td>
<td>A reduced cost of adoption, funded by a secondary revenue stream, often via the sale of data</td>
<td>Sale of fitness bracelets, where aggregated (and anonymised) data is sold to third-parties</td>
</tr>
<tr>
<td>Platform for co-selling</td>
<td>Where the product provides a means to drive demand for related (and often higher-margin) products</td>
<td>Low-cost printers that order replacement ink</td>
</tr>
<tr>
<td>Platform for cross-selling</td>
<td>Where the product provides a means to cross sell other services</td>
<td>Wind monitoring web-site hosted by a firm that sells a range of weather monitoring equipment</td>
</tr>
<tr>
<td>Benefit Share</td>
<td>Where the consumer pays a proportion of revenues/savings to the provider</td>
<td>Energy management solutions where the provider is paid a proportion of the savings in energy bills</td>
</tr>
</tbody>
</table>
While some business models point to a specific way of charging, others can support hybrid charging models

There are two primary charging models; some IoT products will be sold with a one-off charge, while others will be sold on a subscription or usage basis.

On the face of it, where there is no ongoing cost to the provider of the IoT solution a one-off charge makes sense, while if the IoT solution includes the provision of an on-going service a subscription model is indicated. However, it is not necessarily as simple as that. An internet connected button for re-ordering washing detergent may be sold to the consumer for a one-off charge, but the provider of the button may then take a percentage of the revenues that the detergent supplier earns each time the button is pressed.

In other cases, more exotic, charging methods may be applied, for example in building energy management, the owner of the building may agree to pay the provider of the energy management solution a proportion of the savings they obtain through using the solution.

Current business models fall into two broad classes: the first is focussed on improving existing processes, the second on the creation of new value

Currently, IoT business models can be divided into two broad categories; the first relates to delivering incremental improvements to existing products and processes, while the second relates to the provision of new value through the offer of wholly new services.

These two classes can be summarised as shown below:
The first is based on improving existing processes. The business case for this model is typically relatively easy to quantify as it focuses on reducing existing costs by improving efficiency. The alternative is the creation of an all new product; based on an entirely new proposition that is uniquely enabled by the IoT.

For example, a supplier of industrial laundry machines may be able to quantify the cost savings it would accrue by instrumenting its machines, so that it can manage the servicing and maintenance of those machines more effectively. Given that most organisations will know the direct cost to them associated with mobilising an engineer to visit a machine, it is relatively easy to quantify the likely savings that would be derived from a 10, 20, or 50% reduction in unplanned maintenance visits. This alone could provide the essential business case for the instrumentation of the machinery.

Once machines are instrumented, however, new commercial possibilities are likely to present themselves, with a greater understanding of the operation and servicing requirements of the machines, the manufacturer may be able to offer different charging models over and above the traditional buy or lease options that it has traditionally offered to clients. One option might be to charge per wash, another might be to offer the machinery at a discount provided the client commits to only using the detergent that is provided by the manufacturer. This model can already be seen in action in the home and SoHo printer market – where printers are sold at less than their cost of manufacture, because the manufacturer makes all its profit through the sale of ink supplies.

In other domains, the ability to sense and influence remotely opens up the possibility of completely new business models. For example, the Weather Company, now owned by IBM collects weather data from a wide range of sensors and third-party providers, and sells it on to third-parties.

Different models will be applied within the IoT ecosystem

So far, we have looked at the over-arching business models that will support IoT deployments, but there is also the question of which business models the individual participants within the IoT ecosystem might apply in providing the products and services that make up an IoT solution.

Below we have produced a simple IoT reference model, which describes six different layers that represent an IoT solution. The model begins at the bottom with the physical device itself, and rises up through multiple layers until it reaches the point where the data that the IoT solution generates is ready to be acted upon.

<table>
<thead>
<tr>
<th>Consuming applications</th>
<th>Applications that act upon data/events that flow from the integration layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>Enables data/events to be sent to or consumed by third-party applications</td>
</tr>
<tr>
<td>Data</td>
<td>Data storage, aggregation, analysis and event processing</td>
</tr>
<tr>
<td>Gateway</td>
<td>Message authentication and processing, device management</td>
</tr>
<tr>
<td>Communications</td>
<td>Cellular M2M, WiFi, LP-WAN connectivity, plus network/connection management</td>
</tr>
<tr>
<td>Things</td>
<td>Microprocessors, Sensors, Actuators, power management and data storage</td>
</tr>
</tbody>
</table>
Each layer within the stack represents a clearly identifiable market segment; at the device level there is an entire ecosystem build around the design and manufacture of electronic devices. Within the domain of IoT solutions, these are usually bought outright, although a mix of commercial models might be used to fund the design, development, and manufacture of the devices. The solution provider may pay up-front for the design and development effort as one lot, paying for the manufacture separately. Another approach may be to enter into a volume-based agreement with a hardware design and manufacturing company in which the development costs are absorbed into the per-unit manufacturing cost.

When it comes to the communications layer, IoT implementers can choose to use an established communications network like WiFi, Cellular M2M, or LPWAN. The commercial models that are open to communications providers are relatively limited, this layer in the reference model is likely to be highly competitive, and extremely price sensitive. In the case of WiFi, the transmission costs will be absorbed into the broadband costs associated with the WiFi router, in the case of M2M there are established subscription models that can be applied. In the case of LPWAN where spectrum is essentially free in most instances, it is likely that the types of subscription model already adopted by the M2M segment will apply, although the fees charged will reflect the lower infrastructure costs associated with managing LPWAN networks.

The role of the gateway layer is to handle the receipt of data from the remote devices, and to provide a means for managing the devices themselves.

The data layer deals with the storage, management and analysis of the data that flows from the remote devices.

The integration layer links the incoming data with external applications, this may simply take the form of a data API, to which consuming applications connect or it might call interfaces provided by third party applications, such as asset management products, on the basis of the incoming data.

The gateway, data, and integration tiers represent the fundamental server-side infrastructure that is needed to support an IoT deployment and are increasingly combined to make up an IoT Platform*. The IoT platform is a new, and currently poorly defined, category of middleware. While there an emerging consensus as to what functions an IoT platform should perform, typically an IoT platform provides gateway, data, and integration services. This is a highly dynamic market segment. There is a very wide variation in the breadth and depth of services that are provided. Major technology vendors like Microsoft, Amazon, and IBM are all competing in this segment, with strong industry oriented competition from firms like GE with its Predix platform and PTC (Thingworx). These products differentiate on the quality of the services they provide as well as on price – Many vendors have adopted a freemium model, allowing adopters to use their products free of charge up to a certain scale, usually sufficient to support development or proof-of-concept scenarios, after which users are charged on a usage basis, usually on the basis of the number of connected devices, the total number of messages, or a combination of the two.

The integration layer is perhaps the most crucial element of the stack, as this is the point at which the value of the data collected by the IoT solution is realised, and is currently something that the existing IoT platforms tend to provide only basic support for.

Cloud-based integration platforms already exist, and these use a number of different models ranging from per-transaction pricing, to a flat monthly fee for each connection to a third-party application. Of course, an IoT solution does not necessarily have to handle the end-to-end integration...
of data; a third-party could simply pay for access to the data, and then do the integration itself. Alternatively, the IoT solution might publish a subset of its data to a data marketplace, which provides a platform through which the data can be monetised, in exchange for a share of revenues.

IoT platform providers also need to be sensitive to the fact that there are off-the-shelf technologies that can be assembled by a solution provider that can provide all of the essential features of an IoT platform. Google’s Tick Stack is a collection of open-source technologies, designed to work together, that span the gamut of IoT data ingestion (Telegraf), Data Storage (InfluxDB), Monitoring and Alerting (Kapacitor), and visualisation (Chronograf).

Estimates as to how the overall share of value will be divided between the different layers in the stack vary considerably, and tend to be strongly influenced by a natural tendency to overstate the value that will be attached to your own place in the stack.

As a basic rule, however, the value that is realised increases as companies move up the stack. The “Things” layer will be largely a commodity market, with chip manufacturers fighting based on price and performance (notably power consumption). Some sensor manufacturers may be able to differentiate on the basis of the particular quality of their sensors (in environmental monitoring, for example, there is a lot of innovation in the technologies used to accurately sense gas concentrations) but this will be, in large measure, a commodity market.

The communications layer fares no better when it comes to likely margins, the traditional communications service providers will see immense downward pressure on pricing for IoT connectivity as free or nearly free alternatives like LP-WAN become available.

Beyond the communications layer, the value added by each tier increases significantly, with the greatest value being derived from the integration layer.

**Different players will operate in different parts of the stack**

The complexity of the IoT technology stack is one of the primary reasons why solution providers, whether specialist systems integrators or turn-key solution providers, are likely, in the medium term at least, to make the greatest margins. They take on the, currently considerable, challenge of tying the different layers together. The figure below shows the coverage of four classes of provider in the IoT segment.
The technology stack is further complicated by the fact that some IoT deployments will employ intermediate gateways

While in many cases, IoT nodes will communicate with a central server, many more are likely to interact with an intermediate gateway, which will aggregate data from multiple devices, provide local analysis of the data, and transmit aggregated data, or specific events to the central platform.

In many respects, the intermediate gateways will be “mini” IoT platforms, running on low cost hardware (the equivalent of a wireless router). This is a turbulent and complex market place with vendors like Cisco targeting the high value manufacturing and process control markets, Dell seeking to attract ISVs and high volume applications to its platform, and a number open source offerings based around low-cost Linux hardware.

In the medium term, more traditional models will gain the most traction

An angel investor we interviewed recently said, “If I need an accountant, a lawyer, and a philosopher to understand your business model, then it’s not investable.” These words represent an important warning when considering which business model to apply to any given IoT solution.

In the medium term, the simpler, more traditional, business models will be most attractive to both...
consumers and investors. Manufacturers will be impressed when they can see incremental revenue, higher margins, or lower costs. Relatively few manufacturers are ready to embrace a wholesale shift like the one undertaken by Rolls Royce when it transitioned from “capital sales plus service and support” to a model that is essentially a price “per mile flown”. That is not to say that “as a service” models aren’t going to be adopted, they certainly will, but in most cases they will be adopted in an evolutionary way, rather than as a wholesale transition from the old world to the new.

In the longer term, more exotic models will emerge

Over the longer term there will be a transition to an “as a service” model, enabled by the IoT. The ability to monitor the health of machinery, and track its use creates a host of scenarios where both the consumers and providers of services benefit. Over the next decade we will see a significant growth in forms of fractional ownership of expensive farm machinery and the emergence of models where the original function of machine becomes only a part of the overall value proposition of the service.

Conclusion

The IoT market is still very much in its infancy, and we can expect to see many waves of innovation, disruption, and change. There is no magic bullet when it comes to the choice of technology, differentiation strategy, or business model so perhaps the most important advice to IoT service providers is that they should expect their choices of technology, differentiation strategy, and business model to change over time.

The most successful IoT businesses will be the ones that can adapt over time, flexing, pivoting, and partnering in order to maintain a proposition that is viable, differentiated, and economically sustainable.