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Home Control

HiTech

Home Automation and the Internet of Things:
Building a Profitable Business Model

About the Author

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Abstract

The promise of the Internet of Things (IoT) stems from the explosion of interconnected devices. The large volume of data generated by these devices will open up fresh insights and new business opportunities. However, there are several questions around how to generate revenue from the IoT, beyond the promise of Big Data. As expected, the initial revenue generating models will be inherent in the devices themselves. However, as these devices become more ubiquitous, the costs of hardware will diminish, which will compel businesses to explore opportunities that are more profitable in the long term.

In this paper, we attempt to address some fundamental challenges in identifying a profitable and sustainable business model in the area of consumer based IoT, particularly the home market. This white paper should be viewed as a follow-through piece to a previously published TCS white paper – 'Realizing the Promise of the Internet of Things'[1] – which discussed some technical concepts that merit consideration while evaluating the controllability, predictability, and reliability of IoT. Having addressed these aspects, we now investigate avenues to monetize the IoT concept and propose revenue generating opportunities. We believe that for organizations to successfully monetize IoT, a strong focus on security, economy, privacy, and simplicity is a vital prerequisite.

[1]   Tata Consultancy Service, "Realizing the Promise of the Internet of Things " (January 2015), accessed April 25, 2015, http://www.tcs.com/resources/white_papers/Pages/Realizing-IOT.aspx

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Exploring Opportunities in the Home-based IoT Market

The more we read about the IoT, the more promising it sounds – an always on, highly interconnected, and data-driven world where devices seamlessly and ubiquitously operate around us, much like electricity. The result is the ability to create completely new business streams and models, but the question is: in what form will this new profit making model be realized? We believe, a big opportunity for businesses will lie in supporting IoT enabled homes.

The need for security and economy is the key driver for home based IoT and the biggest reason for consumers to invest in the necessary infrastructure and services. Deployment of locks and alarms is a priority, in fact, the very basis of home security. In terms of economy, consumers are always willing to invest in areas that allow them to save money and reduce bills. This could be in the form of good insulation, energy efficient thermostats, or better lighting mechanisms that are programmed to get activated or deactivated depending on whether a person enters a certain room or exits it.

Home-based IoT must also address the need for privacy and simplicity. Events such as the hack on Sony Corporation's website in January 2015, show that even the biggest companies with large security investment budgets cannot be wholly secured. Moreover, digital technologies have redefined privacy, with people sharing highly personal information over social networks. However, security becomes even more critical when data is shared across devices within a home setup. These 'smart' devices may easily capture interactions and discussions between family members, their everyday routines, as well as precise locations.

Ease of use is also a vital key to success. In the 1990s, it was not unusual to spend hours installing dial-up fax modems to access the internet, and that too, at a speed of just about 56 kbps. In addition, we were required to configure settings, jumpers, and tests, all of which were very specific, and required a lot of time as well as numerous calls to the help desk – all this, for a single device. Imagine having to do this for numerous devices, and one would put off the idea indefinitely. This implies that deploying an IoT environment within the home space needs to be a quick, hassle free, and intuitive exercise. What is needed is the ability to plug and play high speed devices efficiently and with very little technical support. Without this inherent simplicity, the adoption of the IoT will be restricted to technology enthusiasts, and will fail to gain widespread traction in the home market. This ultimately renders any transformative business model irrelevant and expensive.

> Three aspects that need due attention while deploying a home based IoT setup: economic viability, usability, and security.

The Reality of IoT: Understanding its Limitations

On carefully examining the potential of IoT and its supporting concepts, we find several gaps that must be addressed before implementing a business model for home-based IoT products or services. For instance, with billions of devices running round-the-clock, the IoT will generate exabytes of data, all of which can then be stored and analyzed in real-time through external cloud services. The volume of data generated and the use cloud services for its management, are two key aspects that merit consideration when exploring ways to monetize IoT. However, in reality, the ability to generate significant revenues from either of these areas is severely limited. Let's take a closer look at some limitations of each:

Is data truly relevant and contextual?

Facebook has made a stratospheric business out of data. By following user interactions, likes, and dislikes, it has built a data-driven advertising empire. Despite accumulating this rich data and targeting users with relevant advertisements and promotions directly – on their 'timelines' – Facebook makes an average of USD 2.50 per user.[2] For a purely data driven IoT setup to become successful in the home market, businesses will have to tackle challenges related to managing huge amounts of data. A key requirement is to make significant investments in storage space, servers to capture and analyze the data, as well as people to manage data-driven initiatives.

The second challenge is to provide context to data. For example, an IoT enabled toothbrush may have the ability to detect who uses it and how. However, can it constructively analyze the user's dental routine for a dentist? Factors such as diet, both inside and outside the house, flossing frequency, and so on – all impact the quality of teeth and gums. Consequently, without relevant context, the captured data is not of much use. This problem is further compounded when we consider data ownership and device compatibility. For example, getting a holistic picture of the personal hygiene of a consumer at home requires capturing the usage of different appliances such as the toothbrush, electric shaver, shampoo, soap dispenser, and shower. However, to whom would this captured data be sent for analysis? Would the equipment manufacturers be willing to share data with a competing manufacturer? For instance, would a shaving equipment manufacturer want to share their data with a competitor who also makes electric tooth brushes? Moreover, without a profitable opportunity, manufacturers may not be willing to make their devices compatible with others. In addition to the challenges associated with defining context and ownership, both the US Federal Trade Commission and the European Union, demand compliance with regulations pertaining to the use of personal data that covers almost everything in a home setup.

> Success isn't in capturing exabytes of data; the key lies in adding context to it.

How responsive and secure are cloud based services?

After gaining the full support of equipment manufacturers, and meeting compliance standards, captured data can be uploaded into a cloud based service for advanced analysis. Here, vast arrays of computers will analyze the data and a central nervous system will issue commands to direct the connected devices for future action. However,

[2]   U.S. Securities and Exchange Commission, "U.S. SEC: Form 10Q – Facebook Inc." (March 2015), accessed Apr 25,2015,
       http://investor.fb.com/releasedetail.cfm?ReleaseID=893395

businesses are likely to encounter two problems with this approach.

The first is related to latency. Even while performing basic functionalities, a device in a home-based IoT environment is expected to respond to commands instantly – in real-time. For instance, if a light switch goes on or off, the light must appear – or disappear – instantaneously. Even a fractional delay may cause the user to wonder about the effectiveness of the service. This latency issue is further magnified in a home IoT ecosystem, which must also take into account multiple people engaged in various activities. For example, one user may be streaming movies from NetFlix, while another could be watching sports on YouTube. Here, managing internet bandwidth is crucial to ensuring a real-time response. Higher speeds and reduced latency therefore depend on inter-house components that can run on low bandwidth, the router, internet service provider, and most importantly, the cloud service.

Encryption is the second challenge related to cloud-based services. Security is critical for users to gain confidence in home-based IoT products and services. Home protection will need to evolve from simple virus scanners to encrypted communications between devices. Usually, uploading data onto a cloud service will also require encryption keys so that the service can decode and make sense of the interactions. This could result in a single point of security failure with the cloud provider and every home it supports. A more localized approach to encryption, while less lucrative than supporting millions of homes, restricts security attacks to the confines of a single home.

> Latency is a key concern while deploying cloud based services. Even a fractional delay can cause the user to question the efficacy of a service.

How many apps can consumers really manage?

Every IoT device currently in the market comes with its own app. Consumers may therefore end up with a plethora of apps on their smartphone just to complete simple and routine tasks. For instance, if consumers need to switch on the lights, monitor weighing scale data, or open a lock, they have to find the right app, launch the app, and then execute the command. Further, some scenarios can have underlying nitty-gritty, like in the case of opening a lock, where users may also have to ensure that the app is preconfigured to enable geo fencing to enable automatic unlocking upon approach.

Having so many apps is almost counter-productive. It hinders usability and makes it difficult for users to benefit from the IoT in their day-to-day living. Moreover, as mentioned earlier, the IoT in a home environment must take into account the presence and activities of multiple inhabitants. Therefore, the one-to-one relationship between the smart device owner and the app may not work as seamlessly or appropriately as desired, when enabling and managing the home-based IoT environment.

Unleashing the Potential of IoT: Key Strategies for Successful Monetization

Addressing these challenges and limitations will help drive the IoT home market forward. In addition to revenue from the sale of individual devices, new service opportunities can be leveraged to build a targeted home solution based on the essential parameters of security, economy, privacy, and simplicity. Supported by a strong understanding of the current ways of living, businesses can explore the following ideas for home-based IoT solutions:

Leveraging a localized approach: Ensuring security and high availability of services

As we have seen, part of the challenge with the IoT is the sheer volume of data it is likely to produce, and the need for storing – and processing – this data through external cloud services. This leads to notable privacy issues for both the cloud service provider and the homeowner.

Therefore, as an alternative to an external cloud provider, it may be better to first consider the actual volume of information that a single household would generate and whether this data can be managed locally. A localized approach improves security without a significant increase in cost for the homeowner. A single home may include 100-200 devices, which is a substantial investment in itself. Even in a scenario where these devices run permanently, and generate data on a continuous basis or at least every time someone enacts a transaction, a home will perhaps generate no more than 1MB per day. For example, visualize 200 devices generating 50 transactions each that need to be communicated and stored per day, results in 100 bytes of data per transaction. As of March 2015, a 2TB storage costs less than USD 100, which can carry many years of stored data.

The second challenge is processing the captured data and provisioning 'always on' computing and services. Potentially, this can also be provided by a cloud service. Today, an average home uses multiple devices such as smart phones, tablets, routers, and smart TVs and refrigerators. Each of these devices has more computing power than was used on the Apollo space missions.[3] In fact, smart TVs and routers may even be running continuously in the background. Therefore, the concept of a smart hub or a smart device, which acts as a central gateway for all communication and control can provide the foundation for all IoT operations. Extending this concept to cover redundancy will help remove the single point of failure by duplicating the gateway and developing mesh networks within the house. This leads to a solid infrastructure for developing a localized, private, and continuous service. Enhancing this further with local encryption between devices and the platform, brings in a higher degree of technical security. Any platform meeting these criteria is therefore secure, self-contained, highly available, and robust. In addition, a locally managed environment reduces latency. By leveraging low power communication technologies and efficient networking, responses to everyday tasks such as managing the lighting system, will be faster and almost instantaneous.

[3]   NASA, Do-It-Yourself Podcast: Rocket Evolution ,(July, 2009), accessed Apr 25,2015, http://www.nasa.gov/audience/foreducators/diypodcast/rocket-
      evolution-index-diy.html

Providing value where it matters: Improving home security and economy

Home-based IoT has already made some headway in the market – particularly in the areas of heating and lighting – by appealing to the consumers' need for economic feasibility. For example, Nest thermostats use a software that optimizes energy usage. Smart metering is becoming the norm for many utilities, and integrating this concept into gateways and networks at home will allow consumers to create more economical lifestyles. Extension of the IoT into dishwashers, washing machines, fridges, and other household devices will further augment economic benefits.

Applications that leverage the IoT can also be used to monitor open windows, weather predictions, and outside temperature to enhance temperature regulation. Home security is another lucrative area. Integrating locks, doors, and window sensors with discrete cameras provides a comprehensive approach to configure a secure home environment. The seamless integration of these capabilities and extensibility is a natural first step, which will be critical to success.

> Homeowners are looking to leverage the IoT concept for ensuring the security of their homes and to have a convenient, hassle-free lifestyle.

Making way for mass adoption: Keeping it simple and intuitive

Any lucrative IoT business model for the home must be based on simplicity. Mass adoption and consequent revenue generation will depend on plug and play capabilities. Machine learning, automatic device recognition, and capability assessment will be critical to the success of home-based IoT products and services. After 30 years, everyone is now used to video and DVD players, configuring them and planning their recording and playback. However, if on every installation of an IoT device, we end up spending several hours in configuration and testing, IoT adoption will be the realm of technology hobbyists. The gateway should be able to identify a new device, retrieve a capability definition from an internet based specification provided by the manufacturer, and automatically engage and operate. Further refinements in the form of intelligent menus or sophisticated voice recognition and interaction are also likely to drive adoption and deployment.

Hardware and Software Prerequisites for Home-based IoT

Based on the opportunities for home-based IoT, consumers will be required to invest in smart gateways that are highly connected and intelligent central functioning hubs. In order for these devices to be successful, they need to satisfy the following parameters from a hardware point of view:

- Interoperability: Gateways should support multiple protocols, from NFC, Z-Wave, Wifi, Bluetooth, and more.

- Hardware extensibility: The chassis of the device must have the ability to expand in order to allow the gateway to support undeveloped protocols and physical devices.

As hardware prices drop, the real value of gateway devices will come from the software. The ideal characteristics of any software running on a smart device are as follows:

- Algorithms: This includes the use of adaptable and machine learning based algorithms. In fact, the stronger the algorithm, the better the device.

- Multiple security protocols: The software should have the capability to support a myriad security and encryption algorithms.

- ISP independent: The ability to work independent of any particular ISP or other service provider is crucial. This is especially important in rural areas, or where there is limited connectivity. Integration with cloud data gathering and analysis services support secondary tasks (assuming full privacy permissions) but doesn't address the primary purpose of managing the home.

- Extensibility: The gateway must also be regarded as an IoT device and should be adaptable and connectable either through APIs, SDKs, or standard interoperability. Devices should support both inter and intra networking capabilities.

> As hardware prices drop, the real value of smart gateway devices will come from the software.

Assessing the Revenue Potential of IoT in the Home

A scan on the internet shows that a reasonable smart device (like smart lighting setup, smart temperature control kit, and smart safety locks) is selling for around USD 250. Given the potential of covering a majority of homes even in a single country, this in itself is a significant revenue opportunity. Subscription and maintenance charges for additional services opens up another revenue stream. For example, the basic subscription model could include free software upgrades, additional packs of new supported devices, or even hardware upgrades at an extra cost.

As discussed earlier, the savings potential is one of the key reasons for the adoption of IoT in the home. So if a consumer spends USD 250 on a single smart thermostat, they will be looking for a quick return on this investment. Nest's research on the energy efficiency of its thermostat claims heating savings of about 10 to 12 percent.[4] Based on a recent analysis, Ecobee claimed that their customers in the US saved an average of 23 percent on their heating and cooling costs.[5] According to the US Energy Information Administration, the average monthly household energy bill in 2012 was USD 107[6]. In such a scenario, a consumer would recover costs over a two year period with respect to the saving potential claimed by these manufacturers. Marketing benefits such as enhanced security and improved lifestyles could help support such return on investment claims.

[4] Nest, "Nest Learning Thermostat Proven to Save Energy" (February 2015), accessed April 25, 2015, https://nest.com/press/nest-learning-thermostat-proven-to-save-energy/

[5] Ecobee, "Savings from your ecobee", accessed April 25, 2015, https://www.ecobee.com/savings/

[6] US Energy Information Administration, accessed April 25, 2015, http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3

Building a Sustainable Business Model for Home-based IoT

Over the next few years, the market for home-based IoT devices is likely to be a premium source of revenue. This includes existing gateways and hubs, despite their current limited capabilities. The emergence of the 'smart home', managed by truly smart gateways, will provide the greatest revenue opportunity. Smart hubs can be continuously improved with newer software versions. Machine learning will be at the forefront of software innovation. Manufacturers can also earn incremental revenues by supporting a diverse range of devices and device types, and providing homes with a continuously adaptive and developing platform.

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