THE IOT INC. WORKBOOK

BY BRUCE SINCLAIR

INTRODUCTION

This workbook is a companion document to the book, *IoT Inc.: How Your Company Can Win in the Outcome Economy*.

Following each chapter in the book, the workbook provides a chapter overview, a key question to test your knowledge and a short list of free podcasts, videos or articles on www.iot-inc.com if you want to dig deeper into the topics covered in the chapter.

Generally, IoT practitioners are either building a product for their customers or bringing it in-house to be used within their company's operations. The material in the book and workbook cover both scenarios as well as any IoT product – that can be packaged as a discrete product or system or environment.

The book has been honed over the last two years by the hundreds of business leaders I have taught this material to in my live workshops. It contains original concepts and has been influenced by the thought leaders I have interviewed for my podcast and video series on http://www.iot-inc.com. But most importantly it has been battle tested. This is the same material, same approach, I use in the trenches, advising companies big and small on how to plan their IoT businesses.

If you're asking yourself if your company should embrace the Internet of Things, instead ask yourself if your company currently embraces the Internet. If the answer is yes, which it most likely is, then by definition your company must embrace the Internet of Things. It's not a question of if—it's a question of when.

Your investigation of the Internet of Things begins now, but you already know that. By reading the book and working through this workbook, you have already started the journey, so the only question left is how far to go.

Develop the first pass of your IoT business plan now and then integrate it into your company's strategy. This will help decide the timing for the launch your IoT initiative and how much time and resources are needed to move to the next step.

IOT TECH DEFINED FROM A VALUE PERSPECTIVE
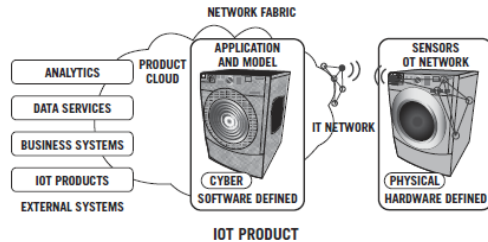
Most look at IoT as a network stack and that's wrong. All incremental value of an IoT product comes from transforming its data into useful information. While it is, information technology, it is not just networking. From a value perspective, an IoT product is a system of four main components: the software-defined product, connected to the hardware-defined product and external systems by the network fabric. A fifth component, cybersecurity, permeates and protects the entire system.

At a high level, an IoT product's purpose is two-fold: to capture data and then to transform it into useful information.
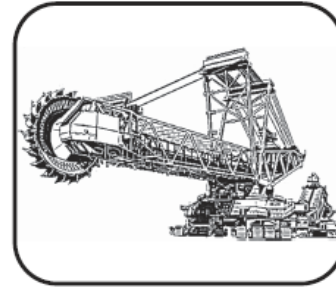
Test Your Chapter 1 Knowledge

When looking at IoT tech, how does the value view differ from the network and design views?

Dig Deeper:

Bruce Sinclair's Opening Keynote at IoT Tech Expo 2016 with Bruce Sinclair, President, Iot-Inc

Introduction to the Business of the Internet of Things with Bruce Sinclair, President, Iot-Inc

CREATING VALUE WITH IOT

Value creation is core to business. When designing your IoT product, the value created must be greater than the costs incurred to deliver that value. To ensure a profitable product, the technique of value modeling is applied. That is, to qualify the value with a value proposition, to quantify the value with a model and to define the requirements of your product. That's the how. What type of value your IoT product generates can be boiled down to four value classes.

IoT tech enables us to make products better (innovation), operate products better (operational efficiency), maintain products better (asset utilization) and make new products… better (invention).
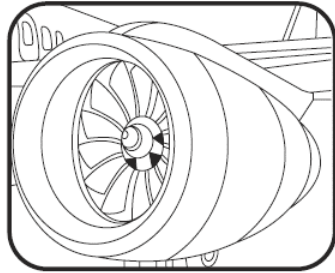
Test Your Chapter 2 Knowledge

What's the difference between a smart product, a connected product and an IoT product?

Dig Deeper:

Panel: Creating Value from Connected Things with the Smart Home Panel

My Opening Keynote at Internet of Things World 2016 with Bruce Sinclair, President, Iot-Inc

MONETIZING IOT VALUE

Once value is created, the next step is to monetize that value. IoT enables as much business model innovation as it does product innovation. And at a high level, the reason is the same: digitization. The Internet of Things allows us to not only digitize the customer's product, but it also enables us to digitize the customer's business. When we see how the customer makes money with our product we can align our business model with theirs, to reduce monetization friction.

The business models of IoT are best understood as plotted on the IoT business model continuum. The five main business model classes are product, product-service, service, service-outcome and the outcome business model.

Test Your Chapter 3 Knowledge

Why does the outcome business model deliver the ultimate win-win?

Dig Deeper:

[Outcome-Based Business Models in the Internet of Things](#) with Edy Liongosari, Chief Research Scientist, Accenture

[New Business Models in Consumer IoT are still Solidifying](#) with Nate Williams, Chief Revenue Officer, August Home

THE CHANGING CUSTOMER RELATIONSHIP

In the past getting primary customer data was difficult. Polls, one-way glass interviews and customer visits were expensive, time consuming and never provided true, in-vitro data. The bigger problem is more often than not, it is never even done. Too difficult. IoT tech changes all this. By digitizing your product and by utilizing usability and utility models, we can see how our customers are using our products and what they are using our products for. And if we go further and capture business data, we can see how they are making money with our products.

This 24-hour, 7-day a week window into our customer's world is profound, changing the customer relationship from casual to intimate.
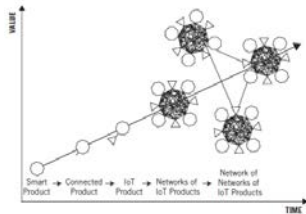
Test Your Chapter 4 Knowledge

How does sales need to transform to best take advantage of this changing relationship?

Greatest Hits (Unrelated):

[The Accelerator as the First Internet of Things Ecosystem](#) with TechrIoT

[IIoT Manufacturing From the Shop Floor to the Top Floor](#) with Tanja Rueckert, EVP, SAP

YOUR INDUSTRY AND THE CHANGES COMING

Products today solve point problems. To get the result, or outcome they want, customers much stitch together various products. Similarly, they must do the same for business: stitch together the business models from each of these individual point products into *their* business model.

IoT tech is enabling the bringing together of products with the IoT platform, and business models with the IoT ecosystem, to deliver what customers ultimately want: outcomes. These two parallel trends will disrupt every industry, changing the borders of competition, disintermediating the vulnerable, subsuming conventional product categories and accelerating industry maturation.
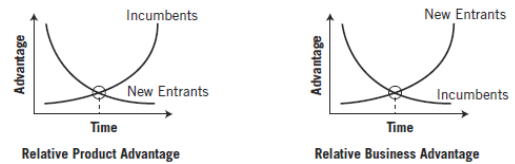
Test Your Chapter 5 Knowledge

How is Tesla disrupting the auto industry?

Dig Deeper:

The IoT Food Chain – Picking the Right Dining Partner is Important with Dean Freeman, Research VP, Gartner

IoT Investing – Where's the Value Being Generated? with Upal Basu & Jesse DeMesa

IOT COMPETITION AND IOT COMPETITIVE ADVANTAGES

Timing is everything and it's no different in IoT. The Internet of Things is simply an extension of the Internet into physical things. If your company uses the Internet, it will use the Internet of Things. So it's not a question of if, it's a question of when. And this is the big question when it comes to IoT competition. When do you develop your IoT? Deploying early is the common competitive advantage you will have over all competitive classes.

The advantages of employing the Internet of Things early include, first mover advantage, creating a barrier of entry and the substantial advantages of a company that has operationally transformed to support their IoT product. This of course must be balanced with the risk of launching a product before the market is ready.
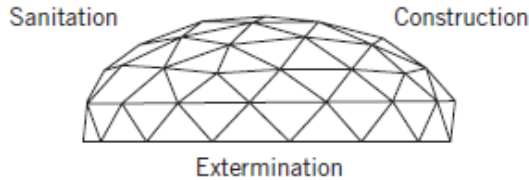
Test Your Chapter 6 Knowledge

What is a left-field competitor?

Dig Deeper:

Mapping the Value beyond the Hype in IoT with Mark Patel, Partner and IoT Services Lead, McKinsey & Company

The Transformative Potential of the Industrial Internet with Dave Bartlett, CTO, GE Aviation

THE OUTCOME ECONOMY

IoT is famous for, or maybe infamous for, its hype. Billions of devices and trillion dollar markets. It's an arms race and the weapons of choice are financial projections. Despite the hype, IoT is real. The technology of IoT may be an evolution but the business of IoT will truly be a revolution and the billions and trillions will indeed be reached. However, this won't happen by maintaining the status quo.

IoT's killer app is outcomes. That is being able to orchestrate multiple products together to deliver the outcomes the customer wants. The IoT platform is the technical underpinning of outcomes and the ecosystem is the business underpinning. It is these ecosystems that deliver outcomes and it's the summation of ecosystems in a given geography that is the definition of the outcome economy.
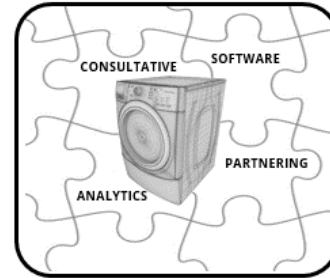
Test Your Chapter 7 Knowledge

Is an IoT platform the same as an IoT ecosystem?

Dig Deeper:

[IoT Ecosystems – the Business Counterpart to Platforms](#) with Bruce Sinclair, President, Iot-Inc

[IoT Ecosystems Evolving Slower than IoT Platforms](#) by Bruce Sinclair, President, Iot-Inc

YOUR NEW IOT COMPANY— DEPARTMENT BY DEPARTMENT

To effectively build and sell it's IoT products, the company must transform itself in almost every way it operates. An IoT enterprise gains value from the Internet of Things by collecting data and transforming it into useful information. This implies a data driven mentality that must become an operational part of every IoT company.

Besides needing to add data science and application software development into a company's DNA, each department is changed and like a maco version of the product, each must collect and transforms data. This affects engineering, manufacturing, marketing, sales, support, business development, human resources and legal. And if best practices are followed, it adds a new department, data, headed by a C-level executive.
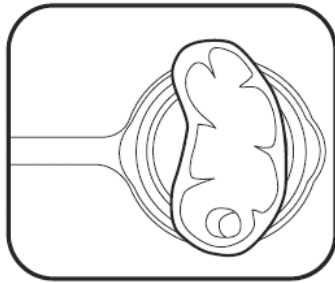
Test Your Chapter 8 Knowledge

How does IoT change outbound marketing?

Dig Deeper:

[The IoT Playbook – Schneider Electric is all In](#) with Prith Banerjee, Schneider Electric

[SME All Star – How to Develop an IoT Business around Data](#) with Christian Shaffer, All Traffic Solutions

DEFINING YOUR IOT PRODUCT'S REQUIREMENTS

Defining the traditional product's requirements is about, well, the product. But because an IoT product is a data gathering machine, we are not limited to gathering product data alone. We can require that our product also gathers data that can help our business and the business of our customer.

The IoT product requirement process takes a 360-degree view and considers not only the product's data requirements to generate value, but the data requirements of our business model and the business model of our customer, data we require to achieve **the** outcome the customer wants, data that can help us in our industry and against our competition, and data that will benefit the operations of our company.
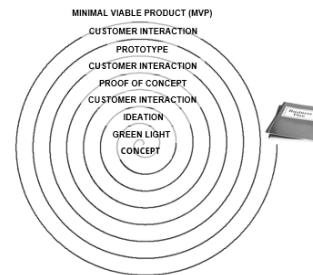
Test Your Chapter 9 Knowledge

What are the key requirements to consider in the 360-degree requirements process?

Greatest Hits (Unrelated):

[Top 5 Application Protocols in IoT Today](#) with Steve Jennis, Dev Bhattacharya, Carsten Bormann and Michael Richardson

[Opening Soon – Commercial Data Marketplaces for IoT](#) with David Knight, Terbine

GETTING STARTED

The IoT business plan and requirements doc takes you from concept to commerce. This is where you get started. The first version, which is developed internally, should be started immediately. It's relatively cheap to develop but it's of high strategic importance and becomes part of your company's strategic plan. Once it's decided to apply resources, to convert the plan into a product, it goes through the product validation process with customer interactions at each step moving forward: proof of concept, prototype and minimal viable product.

But getting started goes beyond the engineering of a product, it must also engineer the right circumstances within the enterprise to ensure **its survival**. After **that** the company must prepare to sell and support the product.

Test Your Chapter 10 Knowledge

Once the requirements have been defined, how does a company decide on whether to build or buy the technology needed?

Greatest Hits (Unrelated):

[The IoT Product Versus the Smart and Connected Product](#) by Bruce Sinclair, Iot-Inc

[IoT Security Assessment – Black Hat, White Hat or Gray?](#) with Paul Jauregui, Praetorian

THE SOFTWARE-DEFINED PRODUCT
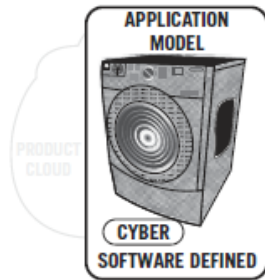
From a value perspective there is no technology more important than the software-defined product (SDP), sometimes called the digital twin. As the name implies, it is a software representation of the functionality of **its** physical counterpart. It consists of two parts: the model (or many models) and the application (or many applications). Together they are a cyber simulation of certain product functionality.

Models and applications are nothing new but what separates the SDP, is that it's a living system, constantly being updated with real world data coming from its sensors and external systems. The model is shared between the SDP and analytics. The application can reside anywhere on the IoT compute surface, which includes the embedded system, fog and the cloud.

Test Your Chapter 11 Knowledge

In general, what type of mathematical models are used in the SDP and IoT?

Dig Deeper:

[Producing the Digital Twin for IIoT](#) with Dimitri Volkmann, Digital Twin, GE

[The Digital Twin and its Paramount Importance to IoT](#) with Hima Mukkamala, Predix at GE Digital

THE HARDWARE-DEFINED PRODUCT

The purpose of the hardware-defined product (HDP) is to collect data from sensors, package them with protocols and send them along the OT (operation technology) network to the software-defined product. It consists of sensors and actuators, and embedded systems.

Sensors convert energy from the physical world into voltages and then into a digital payload. Actuators convert a digital payload into voltages and apply energy into the physical world. Like with sensor and actuators, embedded systems run on the edge, in the physical device or system. They are used as a local computing and memory surface. The trend in IoT is to move compute power closer to the edge, so overtime these embedded systems will get more powerful, taking a bigger role in security and analytics computations.
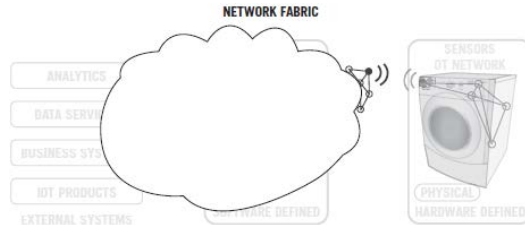
Test Your Chapter 12 Knowledge

What's the difference between greenfield and brownfield deplyments?

Dig Deeper:

[Adding Connected Sensors to your Product for IoT](#) with Adam Justice, VP, Grid Connect

[Trending Cows and Selecting Embedded IoT Chipsets](#) with James Stansberry, Silicon Labs

THE NETWORK FABRIC

The network fabric is literally the Internet of Things and to the uninitiated, it is where the focus on IoT begins. While important, the network fabric is not strategic and should be bought or rented, not developed inhouse. Its purpose is to move data. Move it from the sensors in the hardware-defined product and move it from the data sources in the external systems. Data is moved to the software-defined product where it is used or shuttled to the analytics for processing.

Starting from the sensors, the components of the network fabric begin with the OT network within the product or on premise. This connects to the IT network moves the data to the uplink. Together, the OT and IT networks make up the fog. Once in the Internet, the data is transported to the product cloud.

Test Your Chapter 13 Knowledge

How many IoT protocols are there?

Dig Deeper:

[The Ever Evolving IoT Platform](#) with Bryan Kester, CEO, SeeControl

[Fog Computing Extending the Cloud Paradigm Closer to the Source](#) with Brian Sak & Salman Asadullah, Cisco

EXTERNAL SYSTEMS INCLUDING OTHER IOT PRODUCTS

Interfacing with external systems is what mainly differentiates the IoT product from the smart product and connected product. An IoT product interfaces with the web in the same way as Internet software, because it is Internet software in its software-defined (digital twin) form. External systems access rich sources of data to augment that which is captured internally with sensors in the hardware-defined product.

The main categories of external systems include analytics, data services, business systems and other IoT products. Analytics is different so an entire chapter is dedicated to it. Data services are everywhere on the Internet and include weather, pricing and social data, to name a few. Business systems include CRM, PLM, ERP and SCM. Connecting to other IoT products is strategic and discussed extensively in the book.
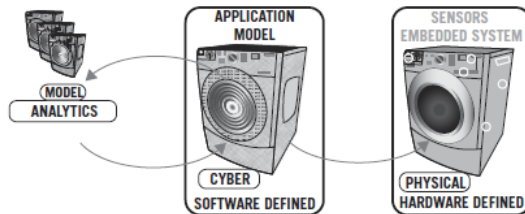
Test Your Chapter 14 Knowledge

Why is another IoT product considered an external system?

Dig Deeper:

[IoT Data Services from the Weather Company](#) with Brendan Hayes, the Weather Company

[The Challenge of Extracting Signal from Noise in IoT](#) with Christian Mastrodonato, Konica Minolta

IOT ANALYTICS AND BIG DATA

Analytics, along with the model and application, is responsible for value creation in IoT. This makes data science strategic and because of this, should become a core competency of every IoT company. The job of analytics is to build models and then interrogate them in different ways to discover or calculate business insights and information.

A good way to categorize analytics is by time. Descriptive and diagnostic analytics look at the past. Streaming and rules engine analytics look at the present. Predictive and prescriptive analytics looks into the future. In all cases the first step in analytics is to build the model. Once built the model is, updated or compared or matched or solved or optimized or trended.
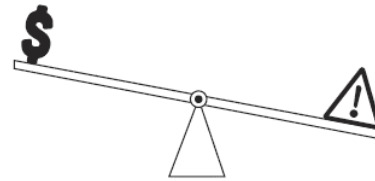
Test Your Chapter 15 Knowledge

Does an IoT product have one master model?

Dig Deeper:

[IoT Analytics Best Practices in Process Manufacturing](#) with Peter Zornio, CSO, Emerson Automation

[Makin' Bacon and the Three Main Classes of IoT Analytics](#) with Shepherd Shi, IBM

IOT CYBERSECURITY AND RISK MANAGEMENT

When discussing cybersecurity, a discussion around risk management should not be too far behind. Security is a technical discussion while risk management is a business one. IoT cybersecurity is different than IT security in two major ways. First IoT security must consider data at rest, but it must also consider data in motion. Secondly, there are more attack vectors to consider because not only do we need to consider network security, we must consider application, cloud/web, mobile, physical and system security. These differences make IoT security more challenging.

Because we don't have an infinite budget, we must explicitly balance risks with costs through a process called risk assessment.

Test Your Chapter 16 Knowledge

Why is implementing an over the air (OTA) update mechanism so important?

Dig Deeper:

[How to Tame IoT's Frankenstein-like Security Monster](#) with Daniel Miessler, HP Fortify

[Risk Assessment for the Internet of Things](#) with Paul Dant, Independent Security Evaluators

ANSWERS

The network point of view looks at IoT as a networking stack. The design point of view looks at IoT as a system with user and customer touch points. Both of these views don't convey the true value of IoT. The value perspective looks at IoT as a system of systems to capture and transform data into useful information.

The main difference is the amount of value they each generate. We've had smart products (local intelligence) for over a half a century and connected products (command and control) for a decade. An IoT product brings to bear the full power of the Internet in the product by going beyond simple smarts and connectivity. Key to this is the software-defined product or digital twin, that encompasses the model and application.

The outcome business model monetized the outcome that the customer ultimately wants. Customers don't want products or even services, they want the end result of these products or services. By selling outcomes the customer risks are lowest as they only pay for success. The vendor's motivations are completely aligned with the customer's and the upside of being paid on success is much higher than being paid for a product or a service.

All operations of the IoT company must change, including sales. Instead of being coin-operated, making a sale, getting paid, and moving on to the next – the salesperson must become more consultative. Once our priorities and motivations are aligned with our customer's it's in sales best interest to advise their customer on how to be more successful.

The Tesla Model S is an IoT product. It has redefined the sports car to be as much about brains as brawn, and has changed how electric vehicles compete. It has disintermediated the traditional car dealer and is starting to subsume auto insurance by offering insurance directly to their drivers based on driving habits. By setting the new standard with an IoT product, all competitors are following their lead, and traditional cars are looking old in comparison.

A left-field competitor is an existing company that is currently not a competitor but could be one when considering customer outcomes. Multiple products and companies are needed to deliver a customer outcome. Outcomes are enabled by the IoT platform and ecosystem. One company in each vertical will own the ecosystem and platform and more importantly, the relationship with the customer. Not all companies will want to develop the ecosystem but for those that do, companies seemingly in left field that offer part of the overall solution, could become a competitor. An example comes from the competition currently going on to own the smart home ecosystem. Philips with its smart

lights are competitors with Honeywell, with their smart thermostat because both want to own the smart home ecosystem.

CHAPTER 7

No, they are very different. IoT platforms are technical, they are sophisticated middleware that interfaces with much of what comprises an IoT product. The IoT ecosystem is all business. It monetizes the tech with a business model that interfaces with the different vendors' and the customers' business models. In the mobile space, iOS is the platform and the App Store is the ecosystem.

CHAPTER 8

While inbound marketing quantifies customer data to help define its priorities, outbound marketing qualifies this data into hyper-personalized contextual messaging. Messaging that is sure to resonate with the customer because it's based on their unique business needs.

CHAPTER 9

For each requirement category, we must ask ourselves three questions at each step along the way. What data do we need for our model? What do we need our application to do? And what do we need from our data analytics?

CHAPTER 10

Your company must develop the requirements related to the core competencies of its business and in regard to IoT, this means the data science required to build and analyzed the model must be developed in-house as well as all applications that interrogate and execute the model. Everything else, to one degree or another, can be outsourced.

CHAPTER 11

The models used are statistical models. Statistical models are improved over time as more data is collected. Statistics is also the mathematics used in analytics. Analytics creates the models and solves them for different goals.

CHAPTER 12

A greenfield deployment is when sensors are included in a new product. Often a single embedded system will control multiple sensors. A brownfield deployment is when sensors are added to existing products, as an overlay network. In these types of deployments an embedded system generally only controls one sensor or sensor array.

CHAPTER 13

There are three main classes of protocols used in IoT. The media layer is the radio which generally transports the data wirelessly from the OT to IT network. Next is the network layer, which is often proprietary in the OT network and always standardized on IP in the IT network. Last, there is the application layer which contextualizes the data payload with other data.

CHAPTER 14

Once virtualized, IoT products can be interfaced with, just like any other Internet software or service. When the output of one product is the input of another, we can organize them as Legos to jointly deliver customer outcomes.

CHAPTER 15

No, in IoT the IoT product will have many models. Think of a model and its application code as a simulation. The product will have as many models as the number of simulations it performs.

CHAPTER 16

An OTA system allows you to update your product with new code to improve functionality and performance, to fix buys and to apply security patches. According to the FTC, 99.9% of attack vectors have had a patch available to mitigate them… for over a year. With an OTA and patch management system the risks associated with cyberattacks are greatly reduced.