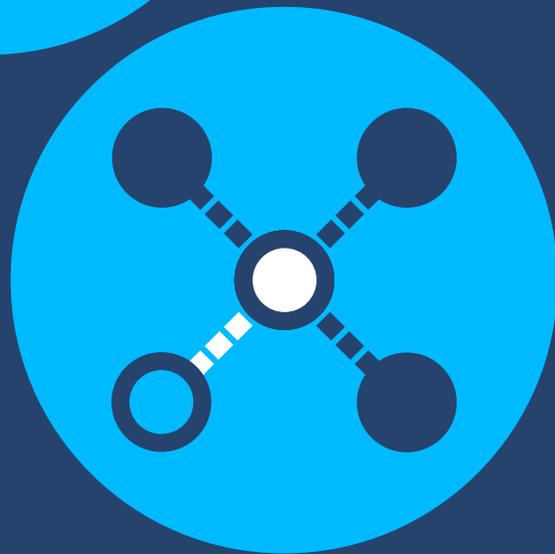


Six Considerations Before Creating an IoT Product



Introduction

Just imagine that you want to build a smart device. The costs of manufacturing, bandwidth, market adoption, and R&D have finally aligned to make this a reality. It really doesn't matter what industry you are in. A smart device (meaning, an internet connected product) can make a significant impact to your business and provide insights into your customers like you've never had before. How? Why? The answers to these questions are contextual to the device and the problem it solves – either for you, the product manufacturer, or your end customer. The data being gathered by an Internet of Things (IoT) device is referred to as “Telemetry.” Telemetry will become core to future product creation, feature development, and Marketing decisions sooner than you think.

A quick note: A fundamental assumption of this paper is that user experience is paramount. And, these six considerations are oversights made when designing the overall experience of your IoT product. Each of these will impact your overall crafted experience.

So, how do you make your IoT idea a reality? First, you need to consider these six areas before making an IoT product.

1. Evaluating Your IT Team. Are They Ready?

Evaluate your own internal capabilities. Seriously. This isn't your standard desktop support or internal software tool. Does your IT team have the ability to host end-to-end massive data acquisition and support end customers, likely around the world, who will require hand-holding on device configuration and connectivity? Standard service level agreements (SLA's) need to be re-visited, redlined, and updated. Don't be afraid to look at pushing your IT team to change and adapt to a new age of support.

Here are three steps to follow when assessing your current IT capabilities:

Step 1. Evaluate your internal IT capabilities.

Is your organization's IT team currently set up for internal-only support? Do you have clear SLA's that have your desktops, laptops, and phones fixed and returned to you within a few days? Does your IT team also keep servers up and running and internal tools in use for a few thousand people?

Now, imagine taking all the devices that your IT team supports and multiplying it by at least a factor of ten. That's what IoT will do.

Now, imagine taking all the devices that your IT team supports and multiplying it by at least a factor of ten. That's what IoT will do. If you are building a customer facing product, it could be 100 to 10000 times their current workload – not to mention the different types of work your IT team will be supporting. Seriously assess if your team can handle it. In all likelihood, it can't. So, find help. But, before you do, go to Step 2.

Step 2. How does your IT play into customer experience?

Now, how does your IT team and ongoing support play into your overall customer experience? When will they be interacting directly or indirectly for or against a customer's experience with your product? Think of it this way. If your server goes down, can't handle extra load, is slow, or gets hacked, how does this adversely affect your IT team? This is where a strong overlap with the overall customer experience journey map (more on this later) makes lots of sense. Finally, once you have a clear idea of how the support will be done and the scale, ensure that the product is built with these decisions in mind.

Step 3. How will you scale quickly in the case of success?

Finally, your IT team will need to handle growth. That growth is unpredictable, so plan for it with a few scenarios. IoT devices will put additional load on all your systems – people included.

A few scenarios worth looking at are:

- Target Product Success
- Overwhelming Product Success
- Not Successful, but not a failure

In each of these scenarios have a clear definition of what the metrics are for success. Obviously, money or the ability to generate income are key, but what about number of customers, number of active devices, devices sold, and device deactivations. And, from this model, how much and how frequently data will be transmitted.

2. Choosing a Radio. Don't Underestimate This Decision.

Picking the right way to connect your device is key. We call this the "choice of a radio." There are lots of choices here and the radio will have many influencers. For example, if it is Wi-Fi, how does it get connected? And, should it be a standalone device that connects to someone's Wi-Fi network? Or, is it a companion device that uses a smart device (tablet, laptop, smart phone) to work? Will the device be portable? Waterproof? Industrial and rugged? Don't underestimate the choice of the radio being one of the most important steps to a successful solution. And remember, one size does not fit all.

The first thing to consider is the context of use. So, ask yourself these questions:

- Does the device need to function with other devices?
- Does the device rely on its internet connection to provide basic functionality?
- Does the device need to be portable and move about with you?

Don't underestimate the choice of the radio being one of the most important steps to a successful solution. And remember, one size does not fit all.

- Will the device have a power connection or rely on batteries?

These questions will unmask how the devices will be further limited and used. For example, if your device does need to be fully portable, you have two options:

- Wireless connection via a wireless telco (e.g. SIM card-connected device similar to a mobile phone)
- Bluetooth-paired device

The Bluetooth pairing forces the devices to be used with a companion app and potentially causes a faster drain on the accompanying smart phone's battery depending on how often Bluetooth is used to create connections to the internet. This could add to user frustration. Also, full portability means batteries. Built-in batteries can be expensive and replaceable batteries introduce other tradeoffs in your industrial and electrical design (e.g. waterproofness and size considerations).

Good news! There are other options, especially in the event that your device is stationary or doesn't change Wi-Fi networks frequently and relies on the Internet for some functionality. Components like the Electric Imp (www.electricimp.com) can be extremely cost effective and offload significant technical challenges and hurdles. An advantage of a pre-built component is that it's already an FCC and CSA approved device. This will help get your product to market faster and provide you with a higher degree of confidence during your safety certification process. Another advantage of a device like the Electric Imp is that you can deploy updates from their cloud portal. Firmware and field-deployed updates are a real pain. Being able to update the software running on your devices is not trivial, but the Electric Imp also has its trade-offs. For example, it is limited to a single wireless connection and relies on an SDK that currently only works with iOS and Android devices.

Other options on the “radio” side of things are all the Maker Community approaches with Arduino backpacks. Even a new comer like Pinocc.io (<https://pinocc.io/>) has some novel device-to-device connectivity with a Wi-Fi-provisioned hub (a.k.a. lead scouts). So, instead of flooding a Wi-Fi network with devices, Pinocc.io boards communicate in a mesh RF network that doesn’t interfere with Wi-Fi. These are all ways of using off-the-shelf components to solve for your context of use. The trade-offs of these devices are cost and mass production. They are usually overkill for simple IoT devices and can significantly increase your production costs. It’s about finding a balance.

Finally, custom Bluetooth electronic devices and some ingenuity can work out the same as off-the-shelf components like Pinocc.io boards. For example, you can set up a mesh BT network with centralized hubs that are within a Wi-Fi / cellular network. Other novel approaches are RF bands approved for home wireless phones (900MHz and 2.4GHz bands) that have huge ranges. Piggybacking on these noisy bands can provide you with a custom, but capable radio coverage. Yet again, there is a trade-off. BLE and NFC chips are still quite expensive and will increase production costs. You will need to weigh these costs against your final price point and work backwards.

You can always custom manufacture your electronics. It’s likely you will need to do some circuit board design. All radios that are inside devices require FCC approval before being sold in North America. This process takes time. Your industrial design partner should be able to guide you through the emissions certification process. If they can’t, let us know. (we can point you to a great firm.) Keep in mind that failing your emissions / safety step can be a “back to square one” step. And, you’ll need your software team to work hand in hand with your industrial and electrical teams.

This is really about existing in a new space that is not in the comfort zone of many organizations.

Confused and a bit scared? You should be. Picking the right radio solution can make or break your product (or seriously cripple customer adoption). You have to build or select components that make sense for your context of use and build solutions around the trade-offs of each radio option.

3. Design. It's Easy, Right?

Alright... you've picked your radio and you've chosen your technical team. Now, you need to sort out the design. Wait. You picked your radio already? Darn. The design, the radio, and the team are all interrelated to the overall design. That makes this a non-linear process (aka difficult). As I mentioned in consideration 2, the radio will drastically impact the context of use of the device. So, let's just assume you are thinking about which radios make sense, but the decision still isn't finalized.

To frame this problem, the most obvious challenge is that companies are either migrating into or away from software. So, this is really about existing in a new space that is not in the comfort zone of many organizations.

What is design? Well, I'm not an expert, but I've been lucky to have worked among them long enough to understand the parts of design that really impact a product's success. You need to be able to stop only thinking about features and requirements. More importantly, this is a multi-disciplinary activity. You'll need to include experts in industrial design, electrical circuit design, mechanical engineering, software, and, of course, user experience designers.

You need to think about and design for the entire customer journey. One of the key techniques we use at Macadamian is customer journey mapping. From these journey maps, we can make rapid prototypes, prioritize and validate features and effort, and create a solid project plan. They are not the only tool our team uses, but it's one that resonates with me as an engineer.

I introduce the idea of a journey map because regardless of your background, IoT will add a degree or two of complexity to your organization. Either you are a conventional product company that is already comfortable building 3D products with industrial design that evokes your branding, or you are comfortable with 2D (software) products that run as bits & bytes on computing devices (mobile, desktop, server, etc.) In both of these worlds, designing holistically means that suddenly your user is interacting with your product in a whole new way that sets new expectations for them.

Find a great industrial design partner. And, don't be cheap. Industrial design is one of the ways you'll stand out.

If your company happens to be one of the latter, find a great industrial design partner. And, don't be cheap. Seriously. Industrial design is one of the ways you'll stand out. Smart devices will need to extend your design language and branding. Materials, feel, and environmental considerations are all key factors in designing a great device. Skimp on talented industrial design and you've already hamstrung your product to the discount isle of Amazon.com. Furthermore, a good industrial design firm will help you with the manufacturing leg of the work. Picking the right moulds, electronics, etc...

Let's call this holistic approach: designing for the context of daily use. This is a daily use pattern of how a customer interacts with your product, and how your product interacts with your customer needs to be thoughtfully designed. Some key questions you need to ask yourself during the design phase are:

- How does your product re-engage the customer?
- How does your product add value in their life?
- What will be the situations that the customer/user will be able to interact with or be touched by/with your product?

Let's be clear: Any data you store on a server can and will eventually be stolen. So, let's think about making it difficult or at least balance the investment in security for a risk to reward ratio.

Today's users expect a multi-screen, multi-contextual, and elegant solution. They expect their product to simply work and be interactive from near, far, and on whatever device screen their eyes are currently staring at. Don't underestimate this challenge.

Start with the entire journey. And, dive into each software and hardware interaction to build your design through the lens of your end user.

4. Software & Data. That's Also Easy, Right?

Software. You might have successfully done some in the past. But, when working with an IoT product, it can quickly become a very different world. Think of it this way. When doing an IoT product right, you've got the ability to gather as much data as frequently as you like and whenever you like. We are talking about gathering from potentially thousands, millions, or even hundreds of millions of connected devices depending on what you want to build.

Let's be clear about that data: Any data you store on a server can and will eventually be stolen. So, let's think about making it difficult to steal or at least balance the investment in security for a risk to reward ratio. Take simple precautions and use services that aren't your core business. This not only eliminates product development and maintenance costs, but also helps to protect your brand.

Ask yourself: How much is your data worth? What are the costs of it being stolen or compromised? Find your comfort zone and invest your time accordingly. You can try to build the "Fort Knox" of security and still very likely fail to keep hackers out.

5. Remote Control & The Physical World. This Isn't a Toy R/C Car.

Most devices aren't just gathering data. They may also be sending control signals that interact with the physical world over digital to analogue outputs. When control is needed,

How you craft your support experience will directly influence your user's experience.

and this is frequently, you start adding a ton of potential value to your customers. It's no longer just fancy telemetry and data gathering devices that could potentially be done via humans, log files and a few R&D patches. Based on telemetry information, the smart device can now interact with the real world and create reactive experiences. To do this well, security and standards should be a priority for your product roadmap. Note: Be cautious of the many standards organizations and take this one with a grain of salt.

6. Support and Warranties. Reconsidering Tech Support.

Let's use the Nest Thermostat as an example. When you call their support line with a serious problem, you actually talk to an HVAC professional and not just tech support. This isn't a lightly trained telemarketer / phone support personnel who walks you through simple FAQs. Support, warranties, and how you handle these will directly affect your brand and your overall customer experience, and therefore, your customer adoption and market penetration.

How you craft your support experience will directly influence your user's experience. Ignore this step, or try to act like an old fashioned Telco, and you might as well have not even started.

Don't Be Afraid.

Get started. Now that you have considered these six areas you're ready to begin creating an IoT product, don't be afraid. The value of both the positive impact it can have on your business and the insights it can provide into your customers makes creating an IoT product an exciting consideration.

So, Get Started.

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by Geoffrey Parker, Director of Healthcare Software Development

About the Author



Geoff is Macadamian's Director of Healthcare Software Development and is responsible for technical leadership, technology partnerships, and sales engineering. Geoff thrives on working with clients to identify and deliver the right solution for their individual needs. His career as a software professional has focused on delivering highly complex mobile and server side technology solutions. Geoff is happiest when pushing the technology envelope by doing things that haven't been done before. He has a Bachelor of Information Technology with Honours from the University of Queensland, Australia. When he's not coding, you can find Geoff on the backpacking trails.

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Thank you.

m a c a d a m i a n

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