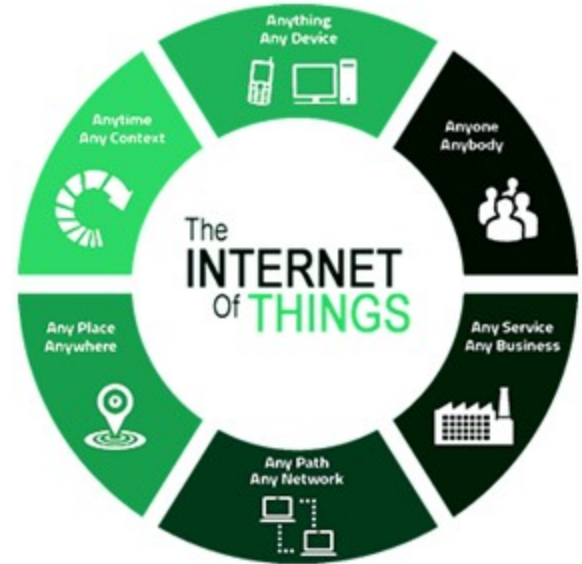# Webinar on

How to rapid design and manufacture Electronics for your product - A guide to hobbyists and startups

By:

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The
INTERNET
Of **THINGS**

- Anything Any Device
- Anyone Anybody
- Any Service Any Business
- Any Path Any Network
- Any Place Anywhere
- Anytime Any Context

Fasal

http://fasal.co

India Technology Week
@Home 2020
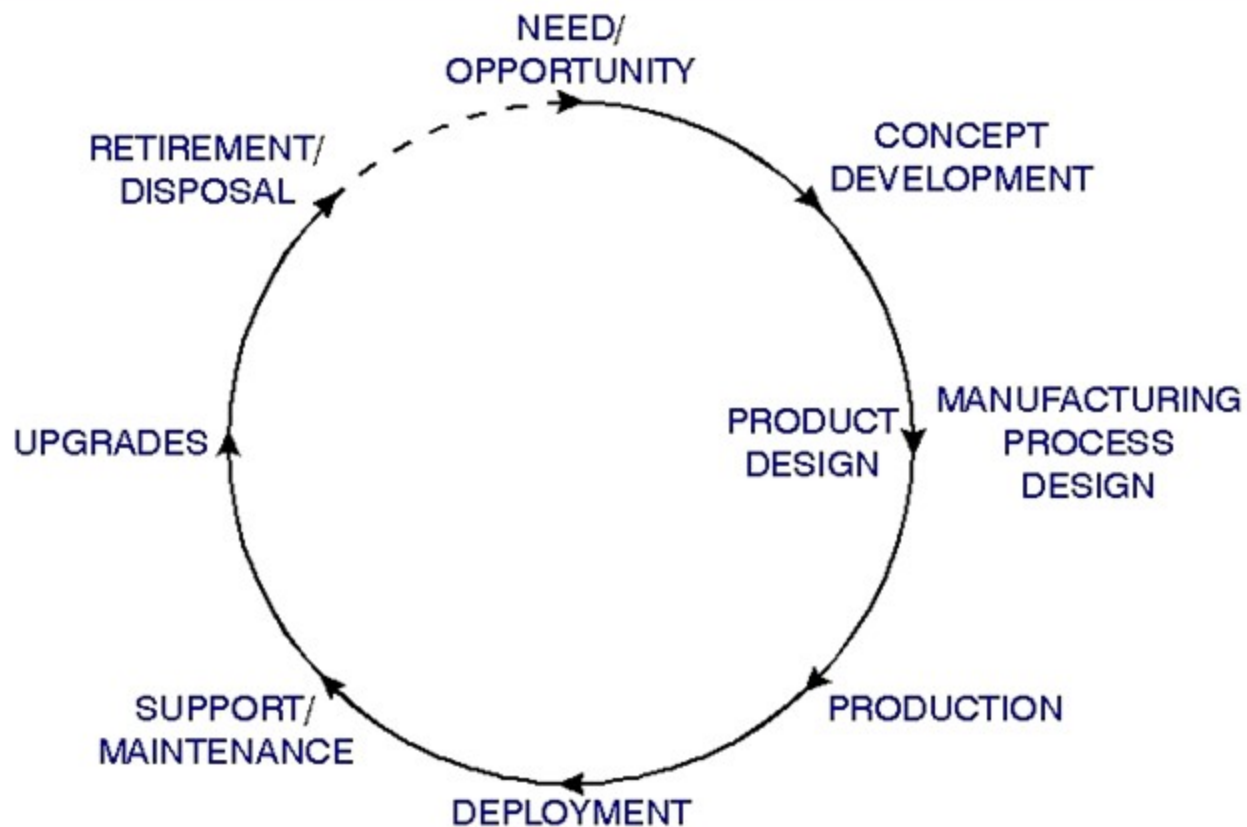
Hardware Business Models

1. **Hardware-as-a-Service**
   - Break-even device sales
   - Recurring fee – software license or service
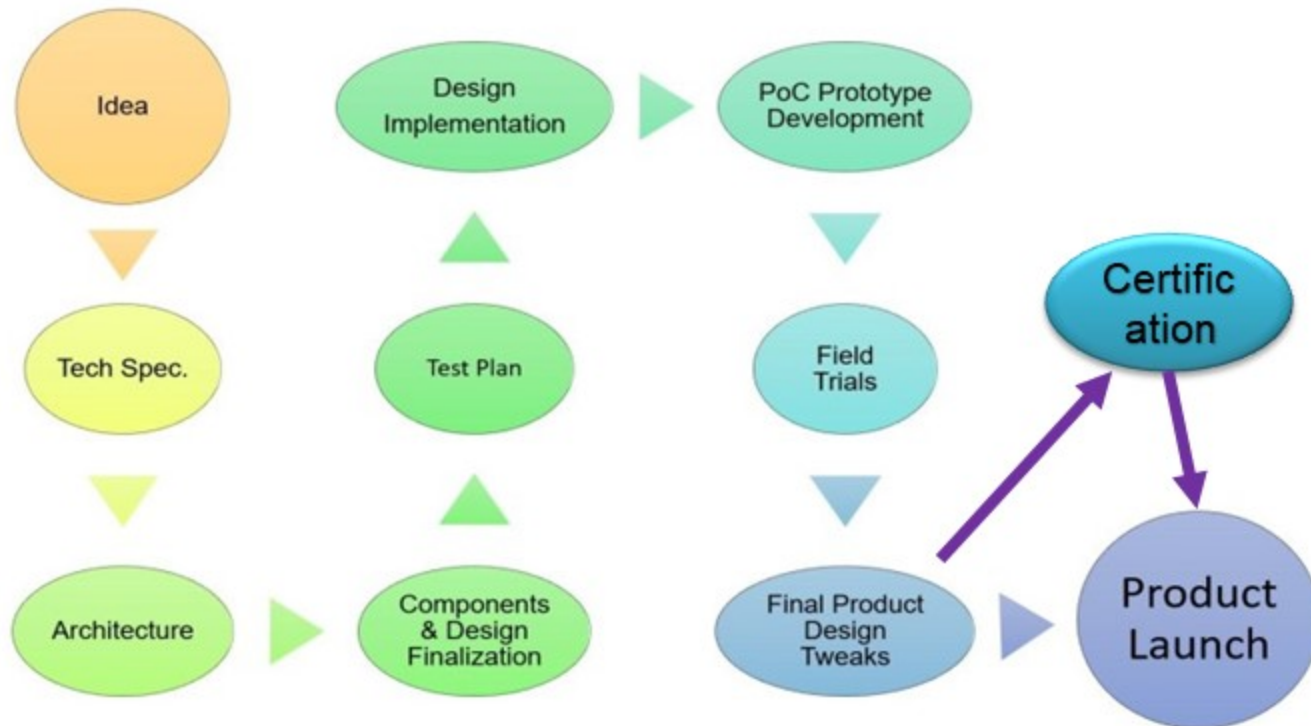   - Per-month / annual / per kb / per liter, etc.

2. **Hardware-enabled Services**
   - High margins hardware sales – 3x Ex-Factory
   - Freemium or low cost recurring charges
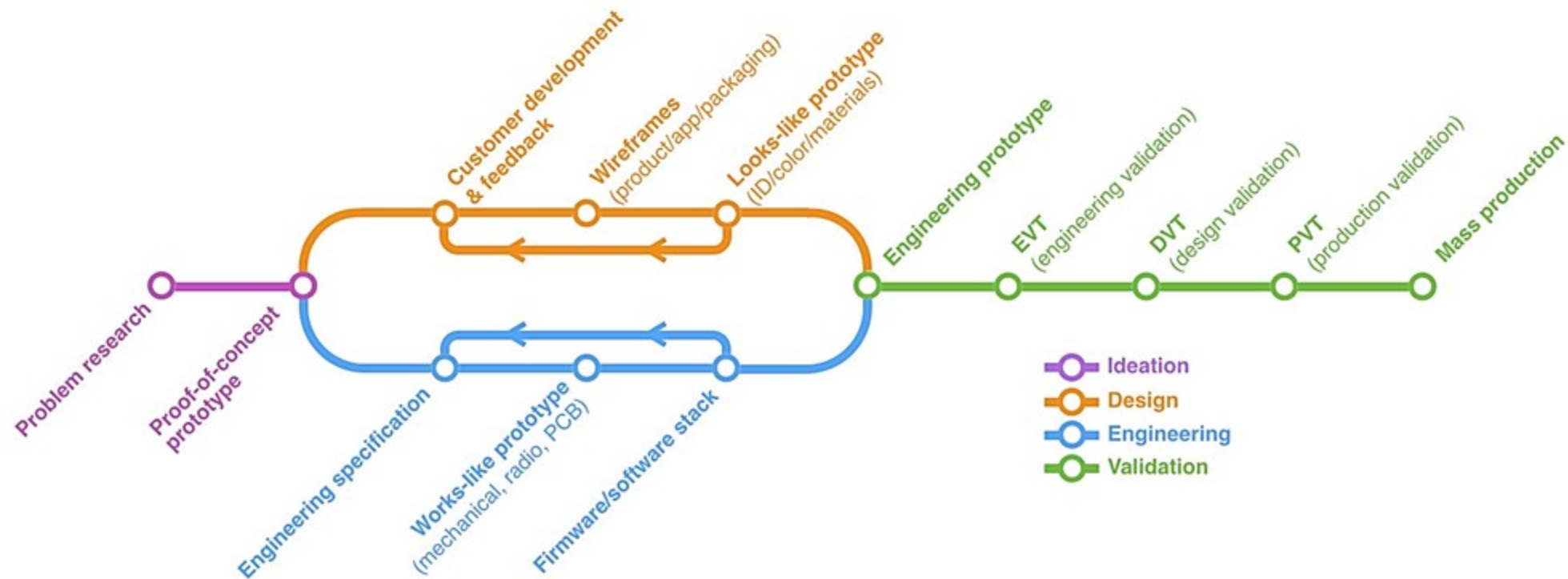   - Eg: consumer products

The Hardware Life Cycle

Stages an embedded system development process

The Four Phases Of Hardware Development Process

Image Courtesy: Bolt

New design
From concept to production (500 units)

Slow & Steady Approach: 12 to 14 months

Rapid Iterations: 6 to 8 months

The Team. Who's in? Who's not?

But Who Do You Hire? There's So Much to Do!

Prototyping

ID

Patents

Software

Plastics

PCB

Firmware

Packaging

Logistics

Retail

The Hardware Start-up Team (Ideal)

1. ## Product Manager
   - In charge of team members
   - end-to-end ops.

2. ## Hardware Design Engineer
   - Incharge of circuit design
   - Responsible for the functionality of end product
   - Incharge of board bring up and debug issues
   - Incharge of component library

3. ## PCB Layout Engineer
   - Incharge of PCB Design
   - Incharge of signal integrity, EMC/EMI, Thermal

The Hardware Start-up Team (Ideal)

4. QA / Test Engineer & Technicians

➢ Incharge of performing Testing, EMC/EMI Validation
➢ Write instruction manuals for assembly, Work with EMS vendors and fabricators
➢ Create test and validation plans / methodologies
➢ Component procurement / QC of components

5. Industrial Designer & Mechanical Engineer

➢ Product Design, Packaging
➢ Product fabrication, testing, validation

6. Firmware Engineer

➢ Incharge of giving life to the inanimate circuit
➢ Develop and test software for hardware (firmware)
➢ System performance and validation

The Team (In Reality)

1. **(Co)Founder(s)**
   - In charge of team members
   - end-to-end ops.

2. **Device Design Engineer**
   - Hardware Design Engineer
   - PCB Layout Engineer
   - ***Firmware Engineer***

3. **QA, Supply chain & Logistics**
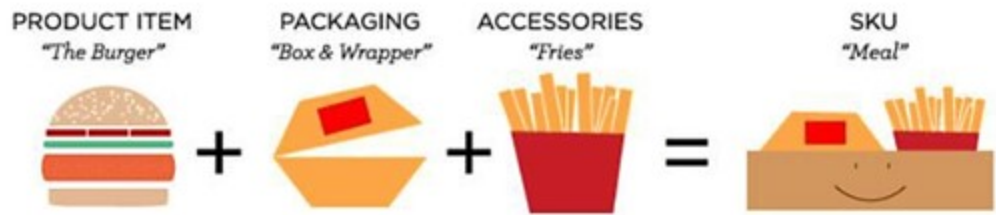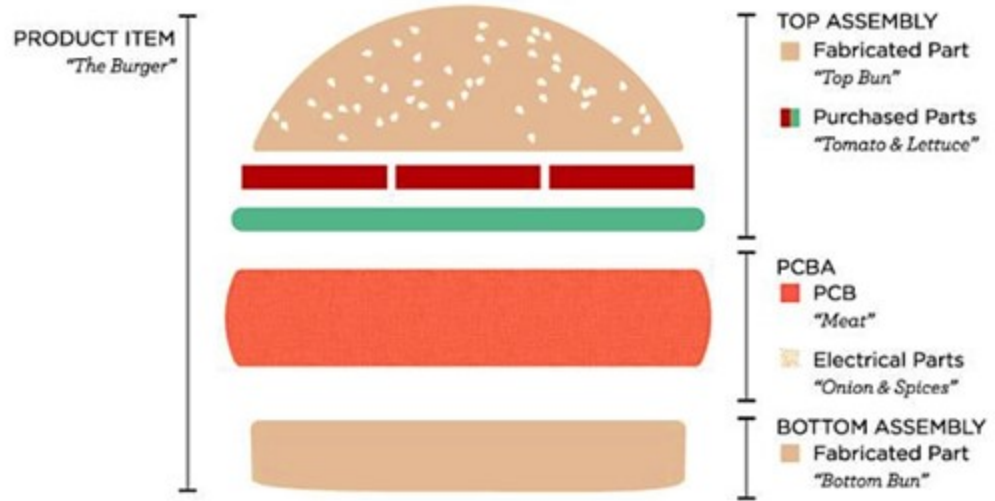
4. **Product Design Engineer ***

* = external design firms

Rapid Product Design

1. Design community >> Arduino, Mbed, etc.

2. OSH Designs >> Quick design and development

3. Electronic Design Softwares
   - Ki-Cad – Free, Community
   - EasyEDA – Free, Online
   - Autodesk Eagle – Paid, Affordable, Mechanical Integration

4. BOM Optimization and DFM
   - Common value components (Res>> 10K Vs 10K and 12K)
   - Availability of components (Lead times, alternative parts)
   - PCB Layer stack-up (2 Vs 4 and above)
   - Component placement (single side vs double side)

BOM is more than parts (only)

WHAT PRODUCT ITEMS ARE MADE OF

PRODUCT ITEM
"The Burger"

TOP ASSEMBLY
Fabricated Part
"Top Bun"

Purchased Parts
"Tomato & Lettuce"

PCBA
PCB
"Meat"

Electrical Parts
"Onion & Spices"

BOTTOM ASSEMBLY
Fabricated Part
"Bottom Bun"

PRODUCT ITEM   PACKAGING   ACCESSORIES   SKU
"The Burger"   "Box & Wrapper"   "Fries"   "Meal"

+   +   =

Challenges of a HW IoT Start-up

1. Cost of goods >> much higher (when compared to SW)
2. Development time >> longer
3. Iterations >> harder
4. Manufacturing must be done
5. Distribution channels >> expensive
6. Teams need more experience
7. Cash flow is constrained
8. AND you still have to build a software product

Things are not so bleak!

1. Data access ubiquity
2. Contract manufacturing
3. Multi-function SoCs (system on a chip)
4. Falling component costs
5. Access to early-stage capital
6. Distribution channels opening up

No, You Can't Manufacture Like Apple. Period!

1. Startups can't do things the same way big companies do. And that's a good thing.

2. Apple is an exception to nearly every rule.
   - CNC machine a million MacBook bodies >> They bought 10k CNC machines.
   - Only one company made a machine that could drill 20 µm holes in aluminum >> They bought the company

Supply Chain. It's not that simple!

WHAT MOST STARTUPS THINK SUPPLY CHAIN IS:

Manufacturer → Logistics → Customers

WHAT SUPPLY CHAIN ACTUALLY IS:

Suppliers → Banks + VCs → Manufacturer → QA/QC → Multi-modal logistics → Warehouse → Retail → Customers → Reverse Logistics
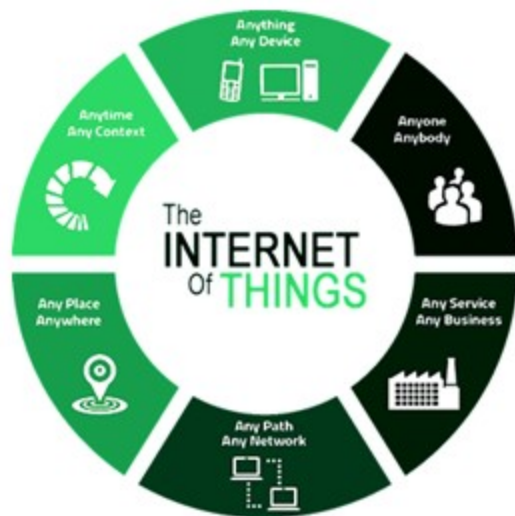
Mistakes that Kill Hardware Startups

1. Over-engineering Kills you!
2. User Expectations >> over-promising and under-delivering
3. Treating contract manufacturers like service providers >> They are as important as VC's!
4. Not having a handle on cashflow
5. Spending crowdfunding dollars on product development
6. Not allocating enough money for marketing

Lower User Expectations!

over-promising and under-delivering
>> Brand RIP!

The dirty secret of exceeding user expectations is lowering them in the first place.