

A man with a beard is focused on working on a small, intricate device in his hands. He is wearing a dark t-shirt and is in a workshop or lab setting. The background is slightly blurred, showing shelves with various items. The entire image has a blue color overlay.

Product
Creation
Studio

A holistic design approach for low power wearables

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Wearable electronics design mission

Low power is good

No power is bad*



*stay out of here!

Who We Are

- Founded in 1999
- Privately held company with est. \$6MM revenues for 2016
- 10,000 sq ft office/lab/shop in Seattle
- PCS+ quality system
- 30+ employees who love to build great products

Key values

- **INNOVATORS:** our teams drive creative solutions
- **COLLABORATION:** match team to client need
- **COMMUNICATION:** nimble project management

Markets We Serve



Medical /Life Sciences

- Diagnostics and Monitoring
- Medication Access and Compliance
- Wearable Therapeutics and Prostheses



Consumer

- Digital/Internet of Things
- Wearable Sensors and Monitors
- Wireless Connectivity



Industrial

- Controls and Automation
- Enclosures
- Value Engineering

A history of wearable innovation



My world:

- Review hardware business models
- Insert PCS services
- Problem: misunderstanding what users want



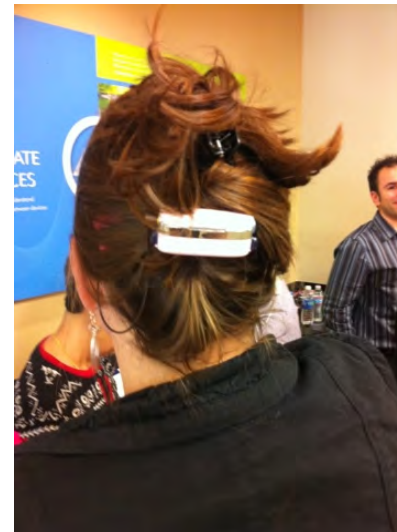
Biomechanics Example

- Initial model: Real-time streaming
- final model: data log w/USB
- use case -> no radio needed



Design for everyday life

- Understand what they want to do
- So you can give 'em what they need
- User interaction models let us prioritize features



Why are priorities critical?

- Stuff we wear is held to a high standard
- Power is keenly mode dependent
- Battery decision feeds back to interaction model



A price is paid to wear

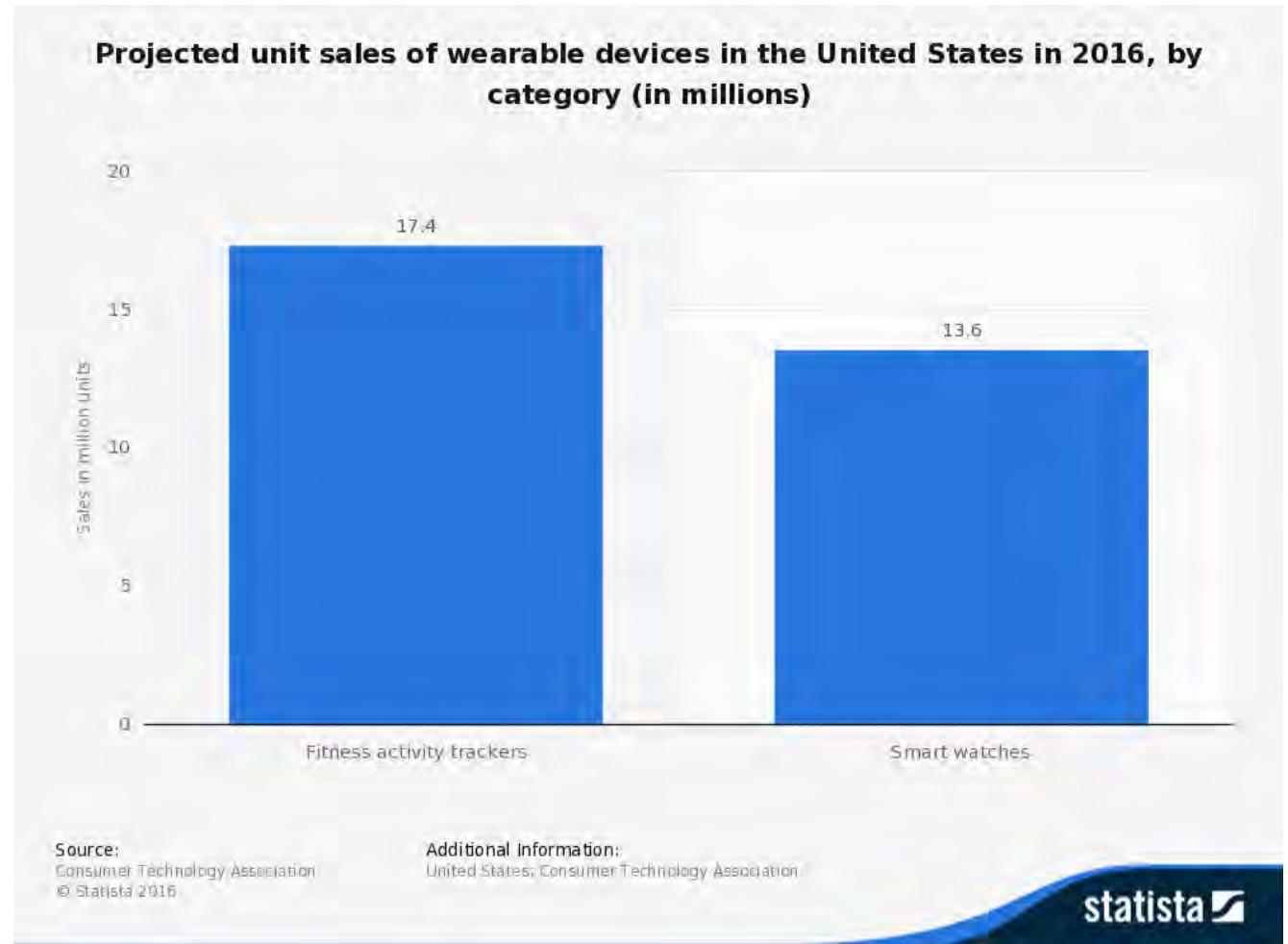


Without enough user reward

- your product is going no-wear
- "I took it off somewhere..."
- ex. child trackers

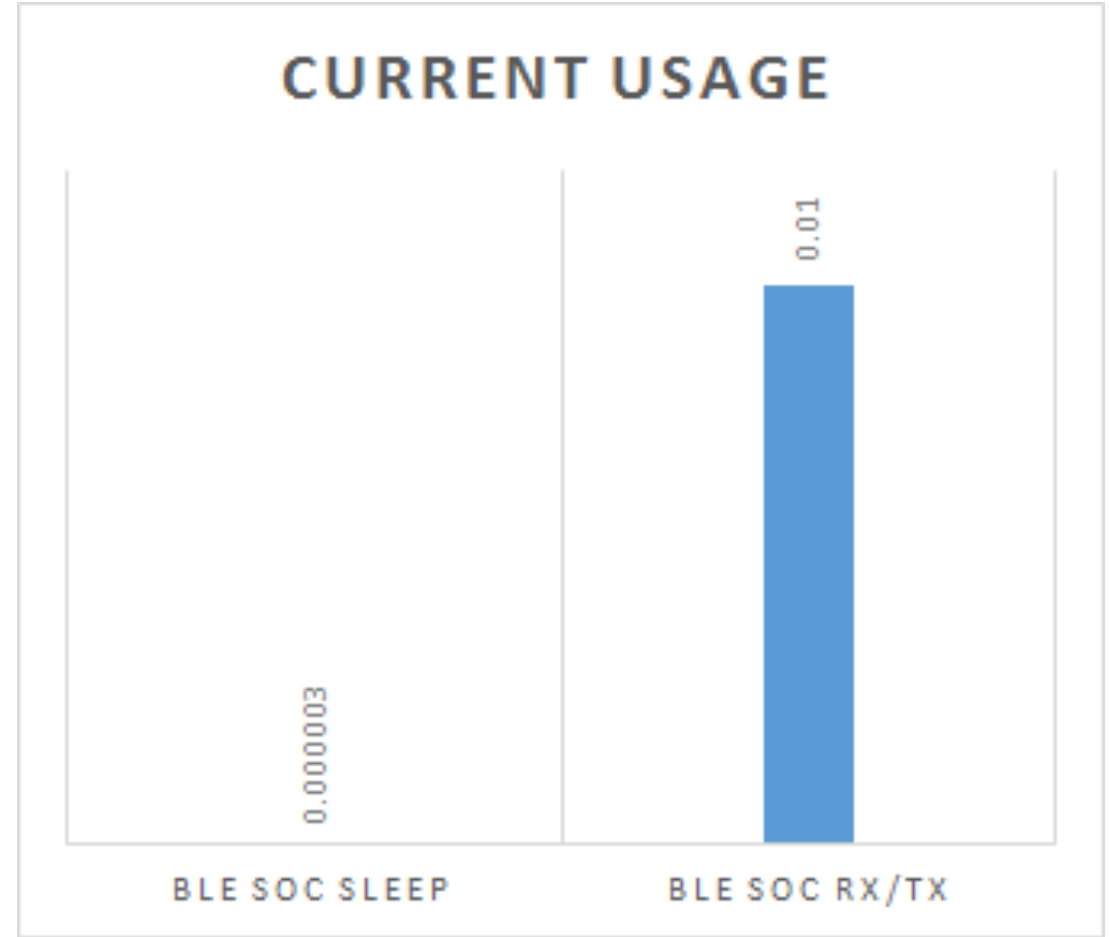


Good wearables make us better versions of ourselves



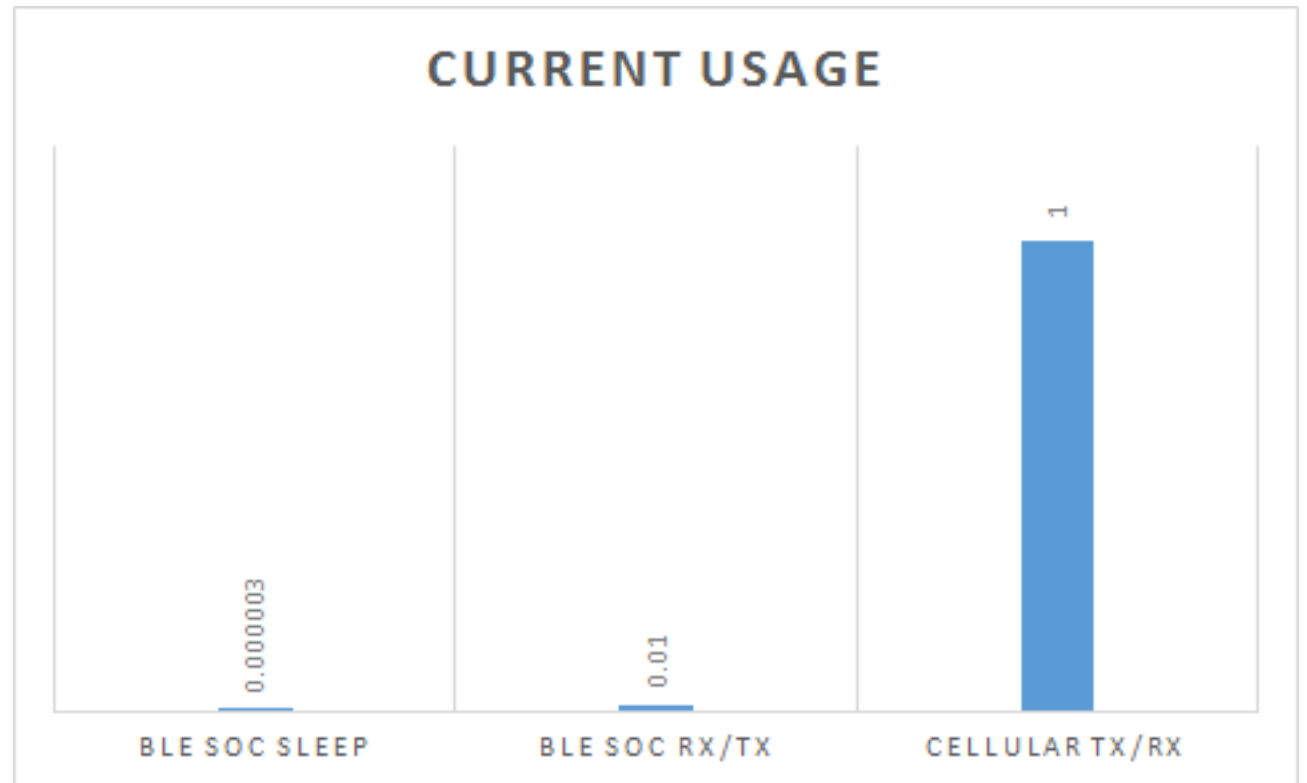
The wearable power precipice

- Your wearable should get it's sleep
- Modes drive power
- Features drive modes
- Prioritize keenly here!



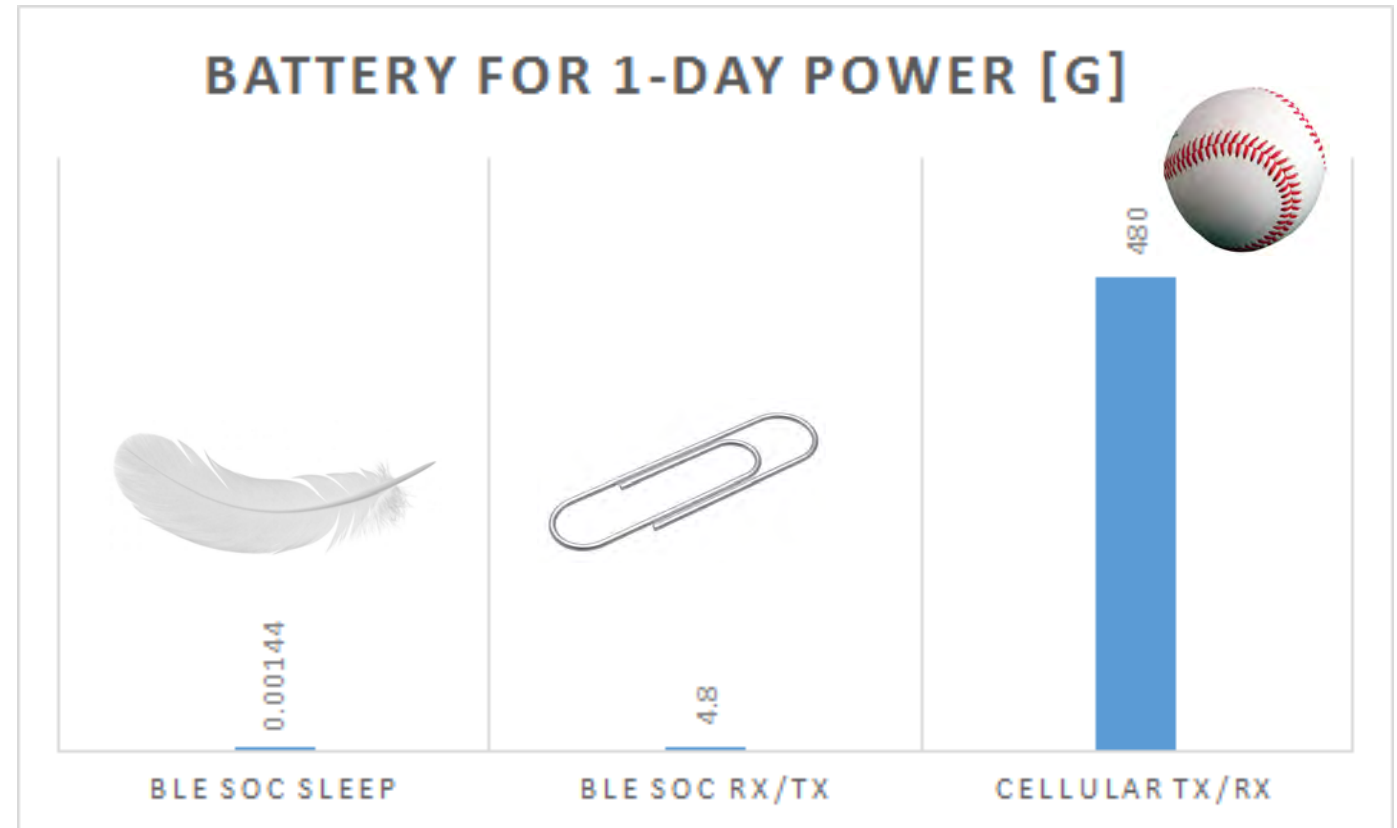
The wearable power precipice - part II

- Cellular adds 2 more orders of magnitude
- Peak power drives design
- Battery selection becomes critical



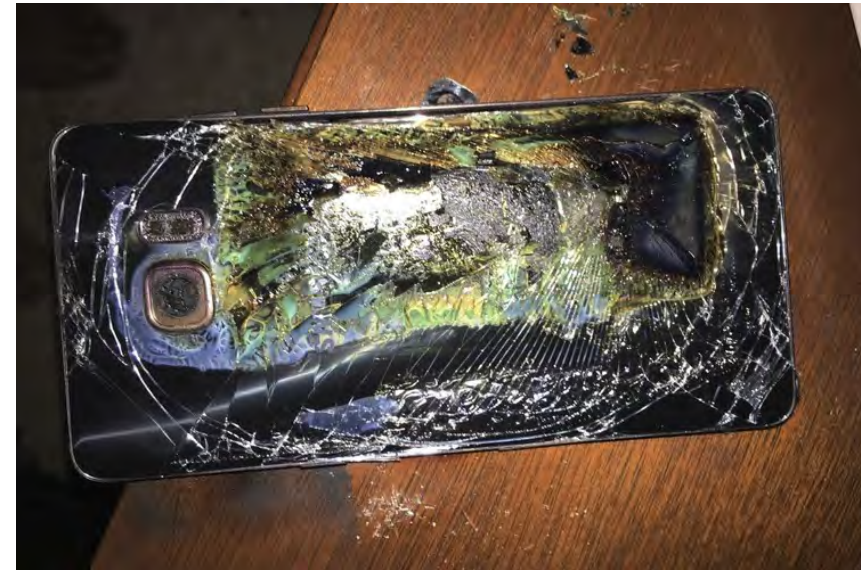
What that means in "battery"

- Primary vs. rechargeable
- Charge strategies
- Product weight



What "battery" means for safety

- High energy capacity
- Small packages
- Mfg & design tradeoffs



“There are few things in life I’m reasonably confident of predicting; one of those is....we’re going to have yet another issue of lithium ion batteries catching fire” from a range of devices, said CPSC commissioner Robert Adler. “This is just a massive problem.”

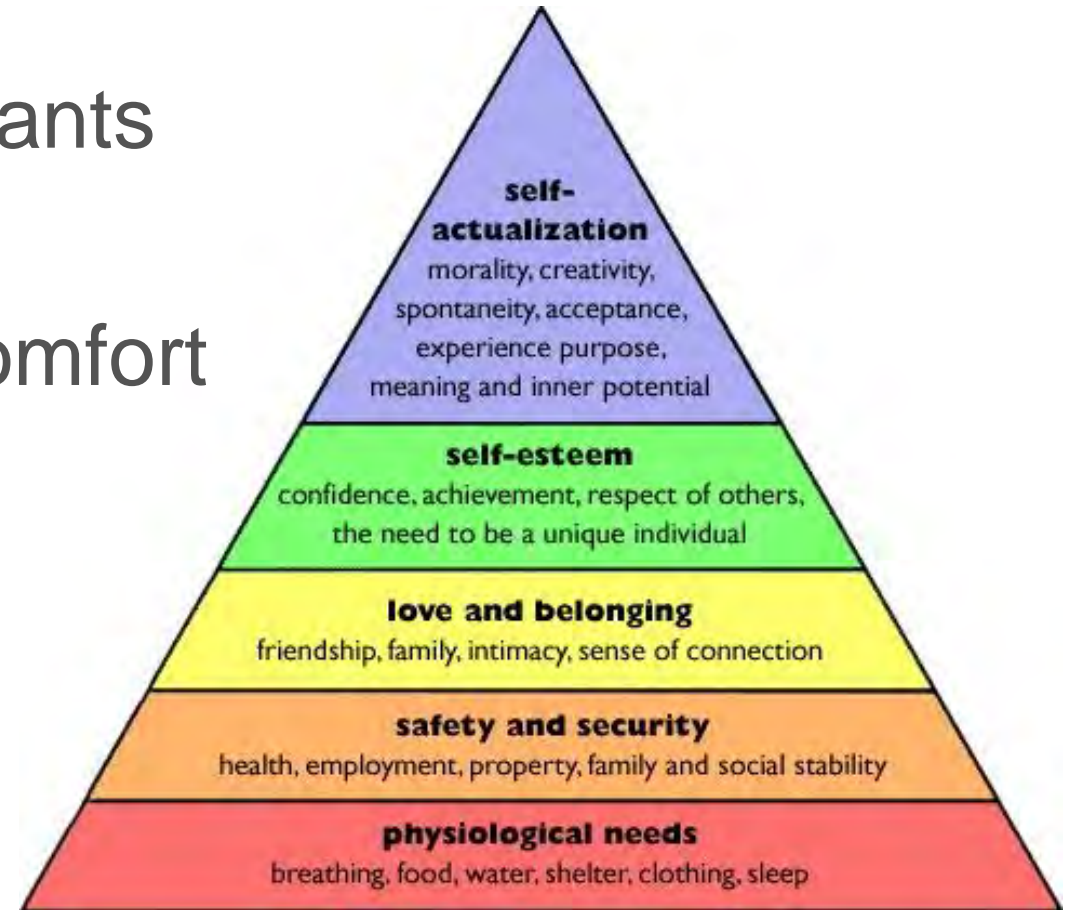
Ok, I'm in. Now what?

- Define user personas
- Use scenarios and environments
- Fill in the blank: "Our wearable meets the human need/want of _____. It does this by _____."



What do people want anyway?

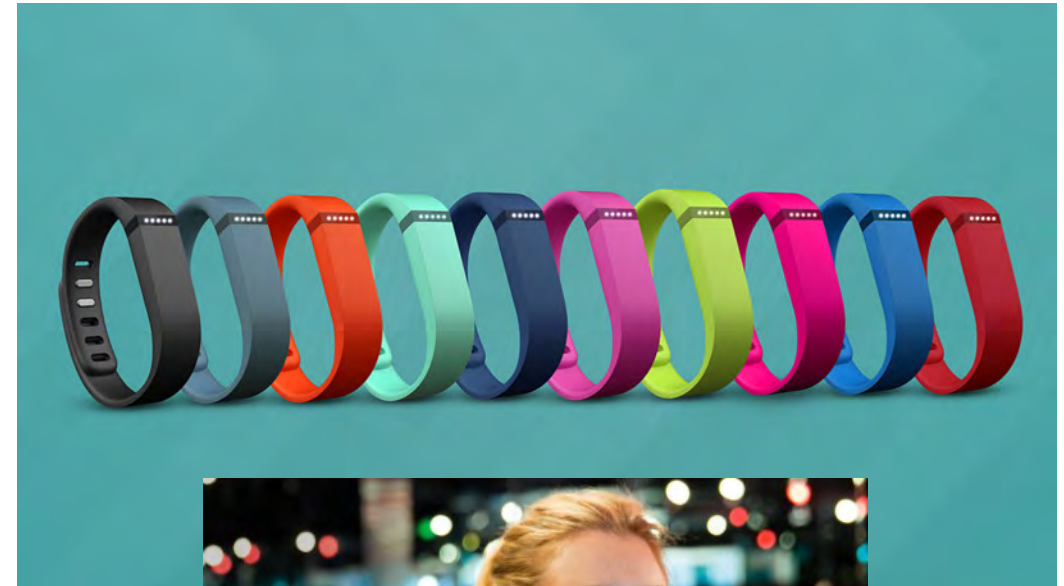
- Maslow's approach to needs/wants
- Human motivation theory
- Don't forget about pain or discomfort avoidance strategies



Fitbit example

- self-esteem: achievement*
- belonging: connection with others
- sleep

*initial value prop.



Back to our biomechanics example

- Our wearable device meets the human need/want for health.
- It does this by enabling movement analysis to identify problems during recovery.
- This alert leads to additional consult with healthcare providers.



User scenarios

- Users wear each day post surgery
- Users upload data via smartphone
- Therapy outcomes result from a relationship with care provider
- No need for real-time data streaming
- No strong need for wireless connectivity



Additional Low power tips

- Choose SOC with flexible power modes
- Watch for resistor dividers in external circuitry
- Favor performance processors - get back to sleep faster
- Choose accurate clock source - minimize sync windows

Summary

- Be aware of the risks obstacles to wearability
 - wearing stuff can be annoying
 - connected features eat battery
 - high energy batteries can be a safety issue
- Develop a model for user interaction
 - base model on motivations: needs/wants
 - weigh resultant features against risks
 - Choose low-power outcomes that still meet needs
 - Then you can dive into the weeds of low power HW/
FW solutions.

Why Us

- INNOVATION
- COLLABORATION
- COMMUNICATION
- 17 years of satisfied clients
- 20+ winning product releases per year
- 60+ product life cycles supported per year
- 1000's of strategic prototyping cycles



WE REALIZE
PRODUCT VISIONS
THAT ENHANCE
PEOPLE'S LIVES

