I am The Cavalry

Hacking Medical Devices

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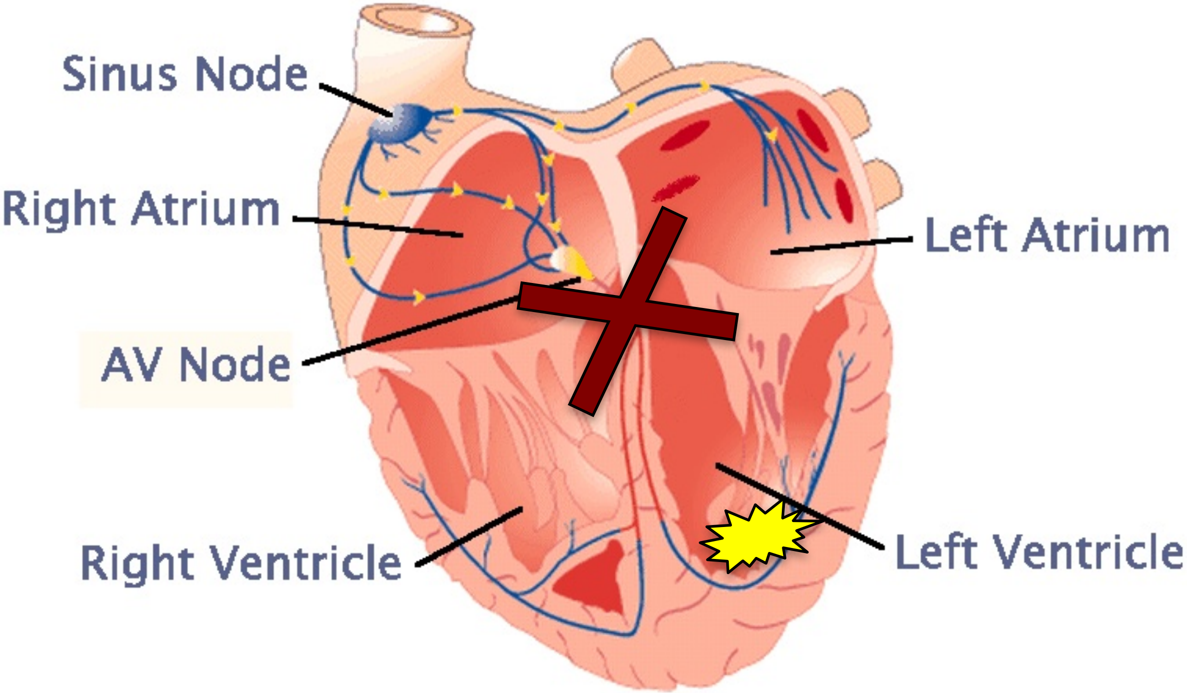
A brief story of my heart

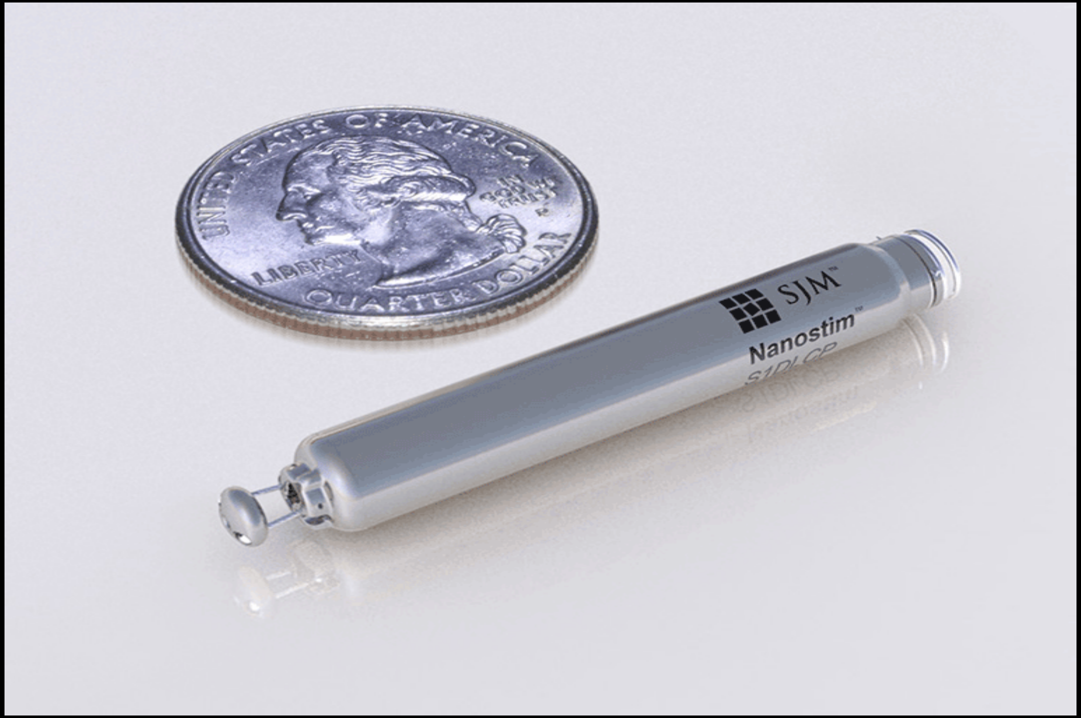
Electrical system of the heart



Pacemaker

https://www.youtube.com/watch?v=-f2FKmMneXY

Leadless pacemaker



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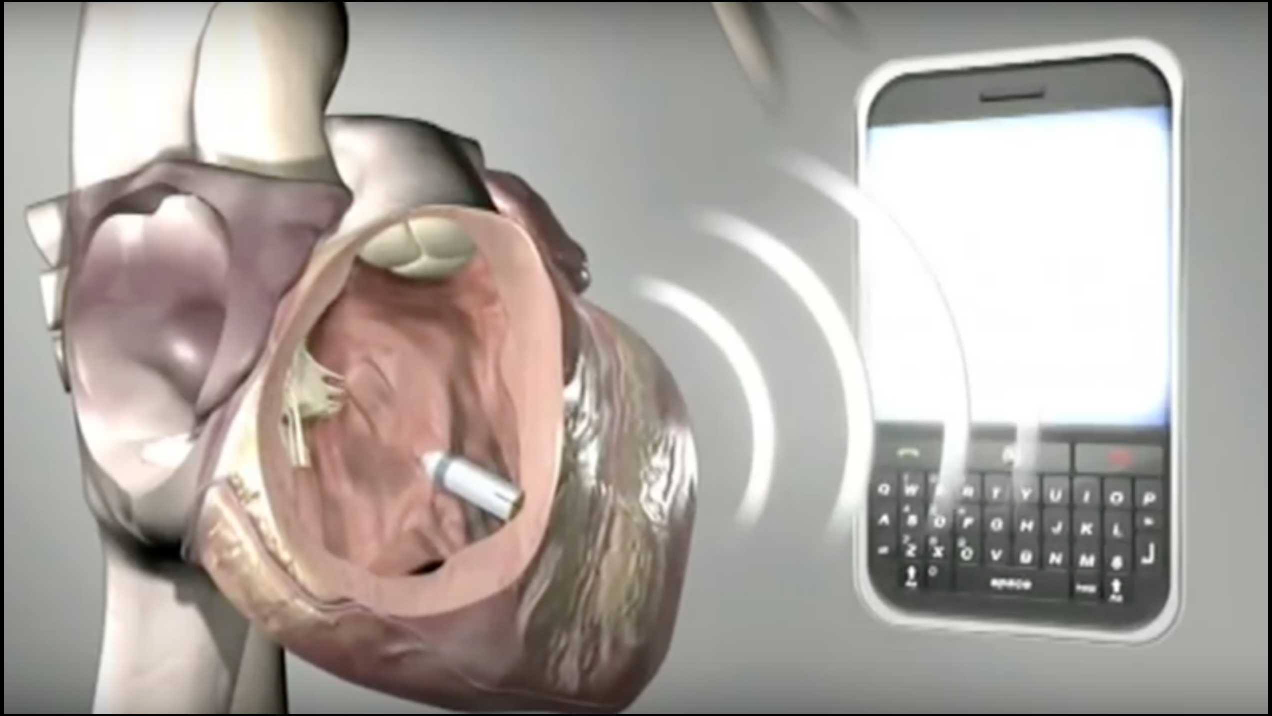
The future?



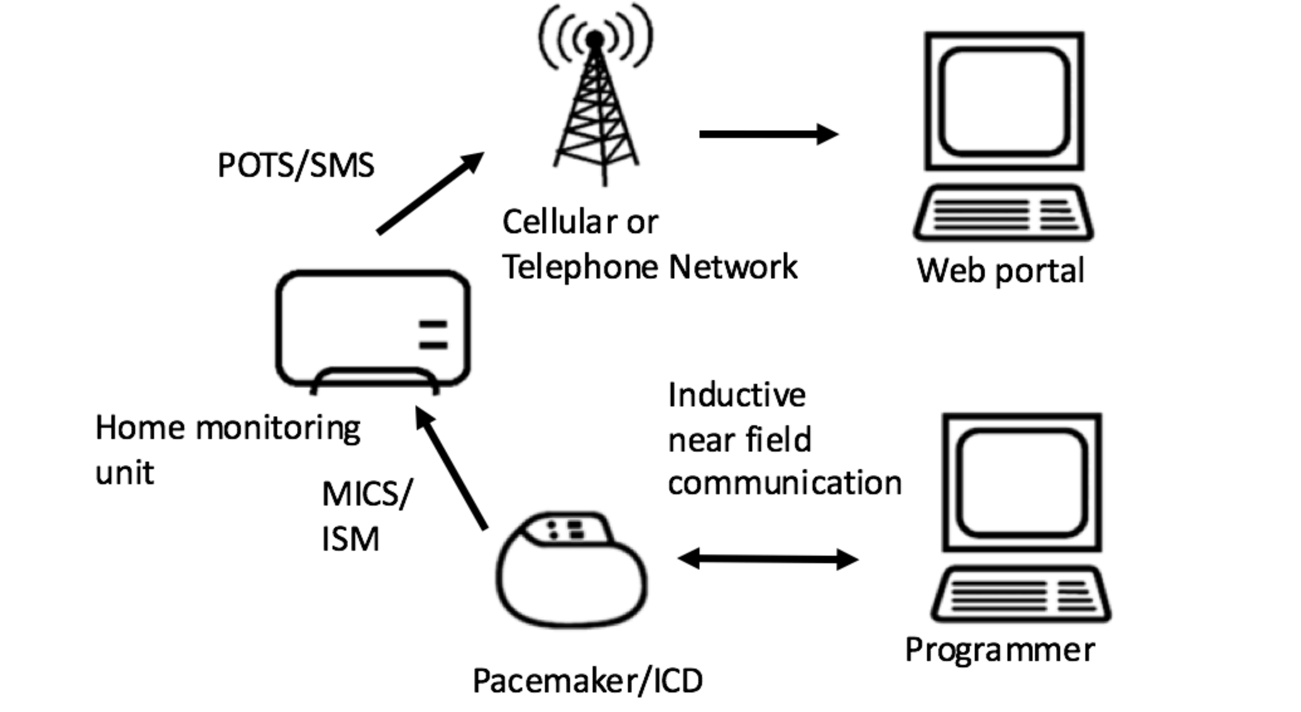
https://www.youtube.com/watch?v=ZiQJIpd2n8k

The future is now

https://youtu.be/JzjXLtR5vkE?list=PLI6tVViVpg8gwKwWjYl8MOMUK8b0Rmm6v

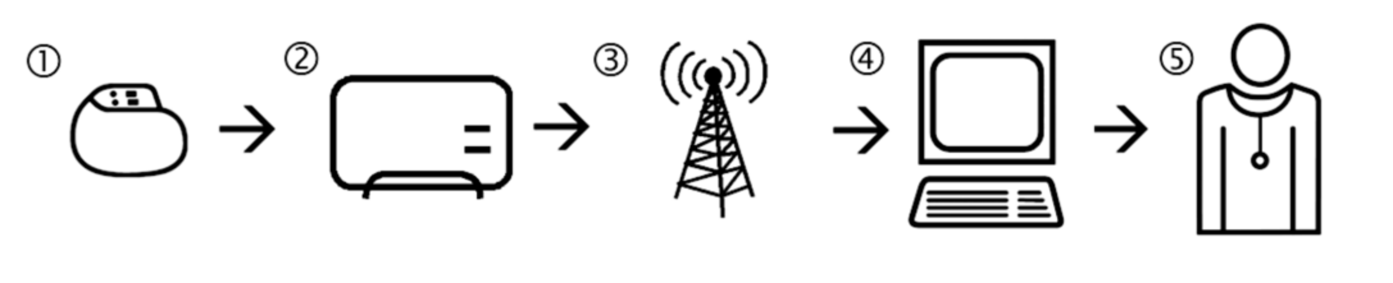
The Internet of Medical ”Things” is real,
and my heart is wired into it…

Remote monitoring



Potential threats

- Device is vulnerable?
- Access point is vulnerable?
- Mobile network is compromised?
- Server at vendor is compromised?
- Web site that doctor logs in to is vulnerable?



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Potential impact

- Patient privacy issues
- Battery exhaustion
- Device malfunction
- Death threats and extortion
- Remote assassination scenario…

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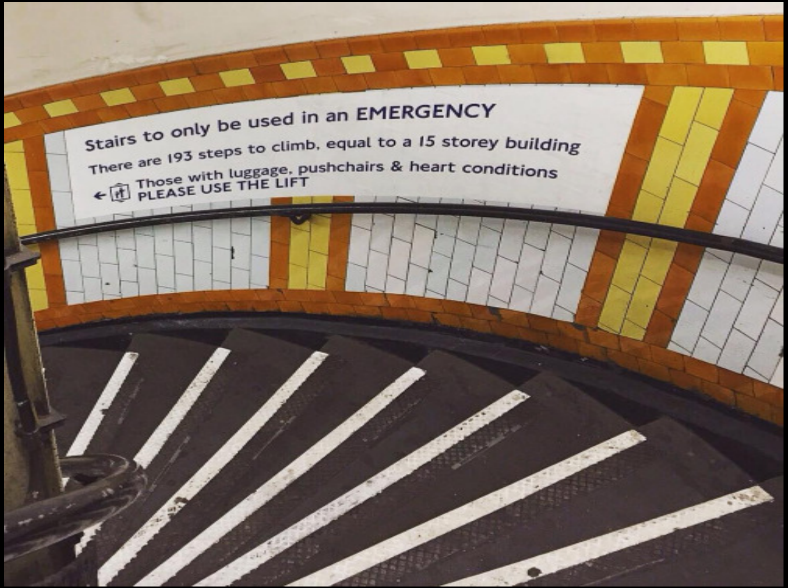
Personal Infrastructure

Your reliance on an infrastructure is inversely proportional to how invisible it is to you.

We all rely on oxygen, our lungs, and our hearts, but how often to we think about them?

How often do we do maintenance or debug them?

The stairs that almost killed me


Stairs to only be used in an EMERGENCY
There are 193 steps to climb, equal to a 15 storey building
← Those with luggage, pushchairs & heart conditions
PLEASE USE THE LIFT

Debugging me

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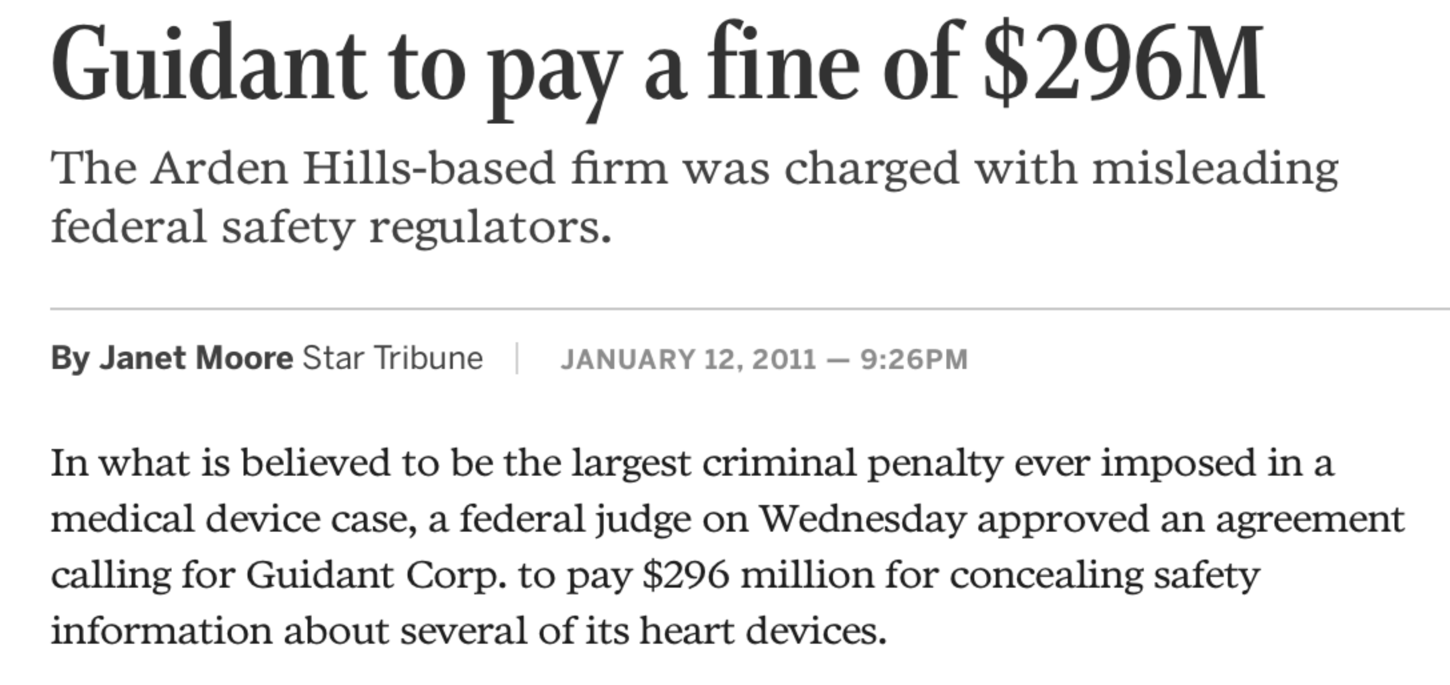
”We need to be able to verify the software that controls our lives”

Bruce Schneier on “Volkswagen and Cheating Software”

When trust is broken



Guidant to pay a fine of $296M

The Arden Hills-based firm was charged with misleading federal safety regulators.

By Janet Moore Star Tribune | JANUARY 12, 2011 — 9:26PM

In what is believed to be the largest criminal penalty ever imposed in a medical device case, a federal judge on Wednesday approved an agreement calling for Guidant Corp. to pay $296 million for concealing safety information about several of its heart devices.

Previous work

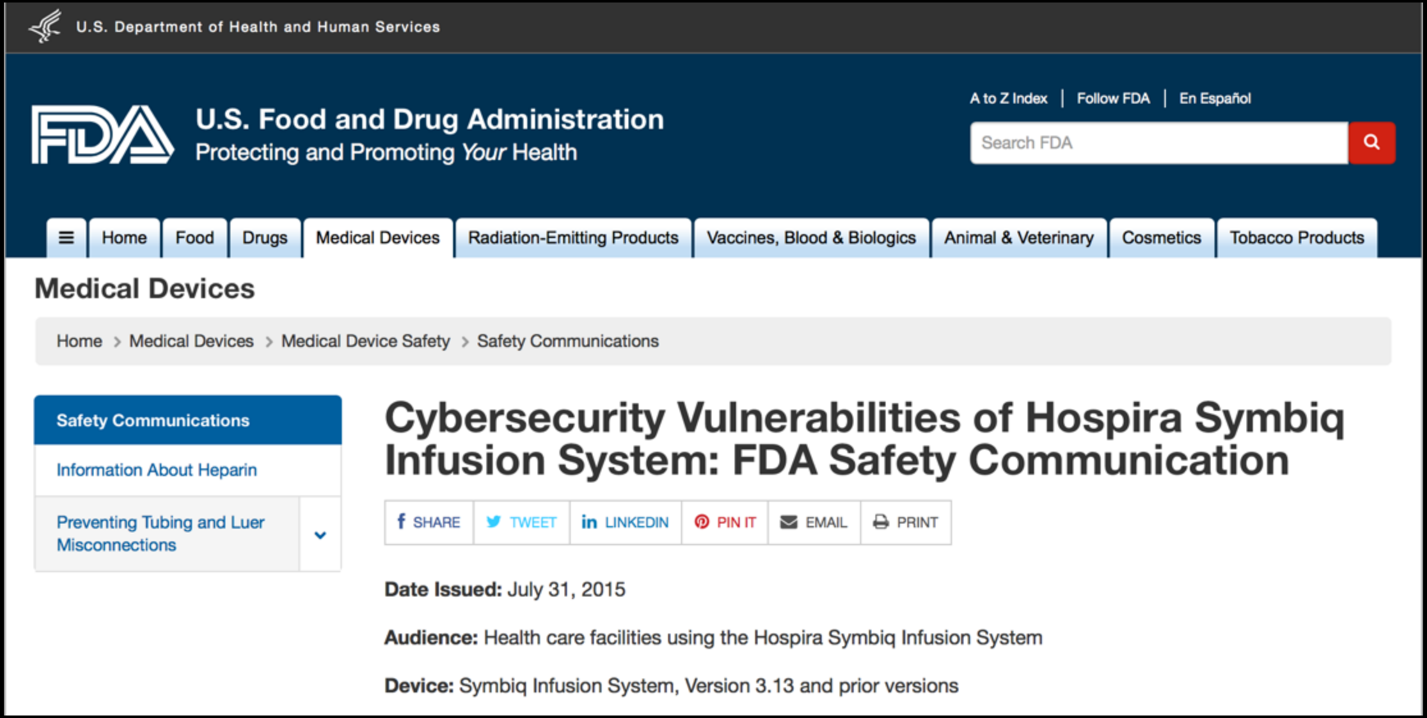
Pacemakers:

- Kevin Fu et al:
  - Pacemakers and implantable cardiac defibrillators: Software radio attacks and zero-power defenses (2008)
  - Mitigating EMI signal injection attacks against analog sensors (2013)
- Barnaby Jack

Other medical devices:

- Hardcoded credentials and medical device honeypots (Scott Erven)
- Insulin pumps (Jay Radcliffe)
- Drug infusion pumps (Billy Rios)

Hacking can save lives!



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Cybersecurity Vulnerabilities of Hospira Symbiq Infusion System: FDA Safety Communication

Date Issued: July 31, 2015

Audience: Health care facilities using the Hospira Symbiq Infusion System

Device: Symbiq Infusion System, Version 3.13 and prior versions

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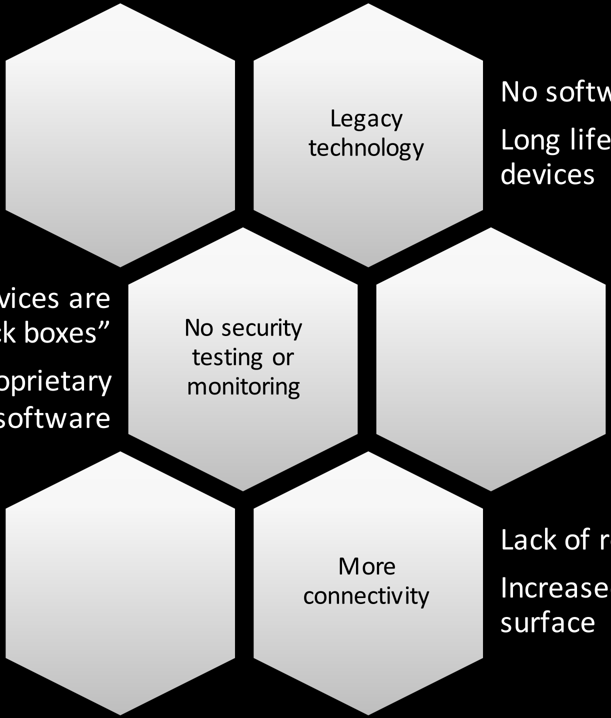
Why?



Legacy technology

No software updates

Long lifetime of devices

No security testing or monitoring

Medical devices are ”black boxes”

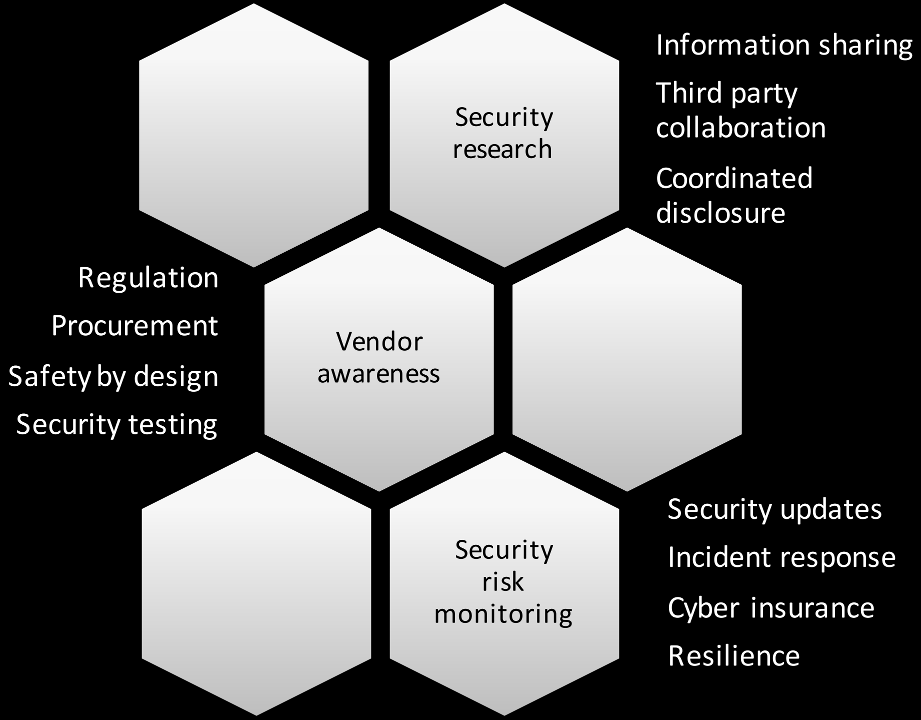
Proprietary software

More connectivity

Lack of regulations

Increased attack surface

How to solve it?



Security research

- Information sharing
- Third party collaboration
- Coordinated disclosure

Vendor awareness

- Regulation
- Procurement
- Safety by design
- Security testing

Security risk monitoring

- Security updates
- Incident response
- Cyber insurance
- Resilience

Hippocratic Oath

For Connected Medical Devices

Cyber Safety Capabilities What is your ready posture toward failure?

- **Cyber Safety by Design** – Anticipate and avoid failure
- **Third-Party Collaboration** – Engage willing allies to avoid failure
- **Evidence Capture** – Observe and learn from failure
- **Resilience and Containment** – Prevent cascading failure
- **Cyber Safety Updates** – Correct failure conditions once known

In Collaboration With

Security Researchers

Patients

Device Makers

Policy Makers

Insurers & Payers

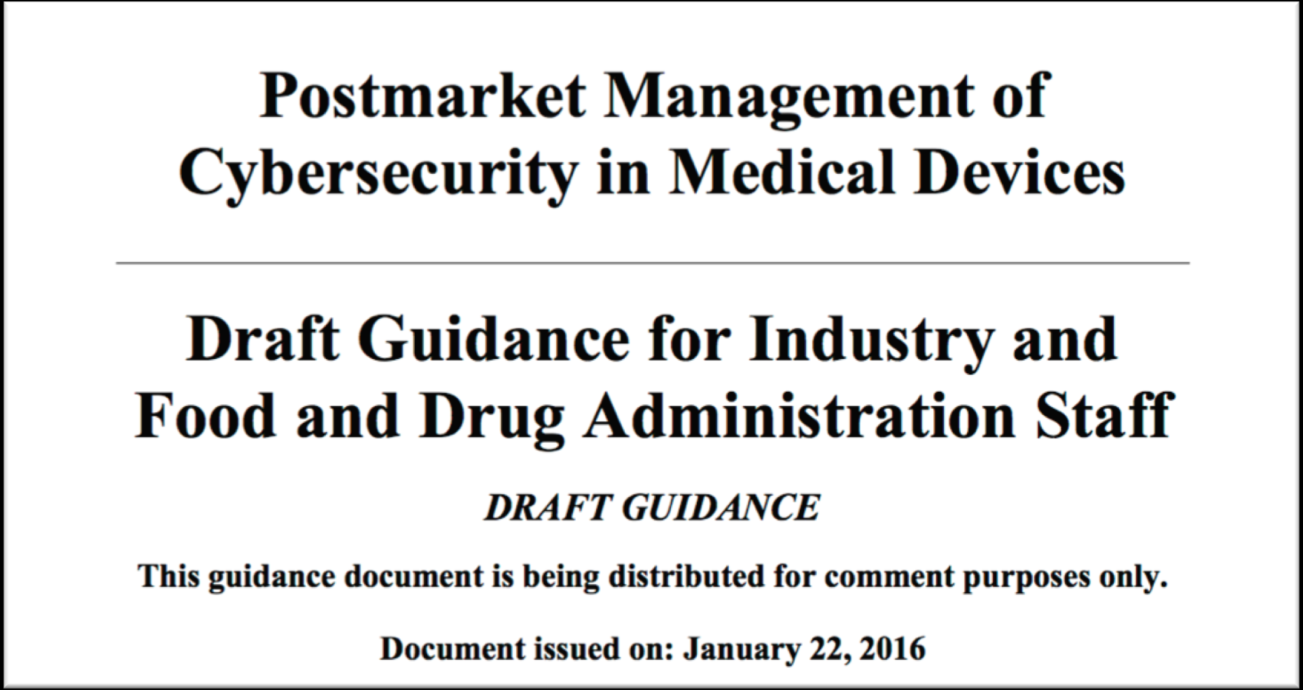
Physicians & Care Givers

Standards Organizations

Healthcare Providers

Government Agencies

https://www.iamthecavalry.org/oath



Postmarket Management of Cybersecurity in Medical Devices

Draft Guidance for Industry and Food and Drug Administration Staff

DRAFT GUIDANCE

This guidance document is being distributed for comment purposes only.

Document issued on: January 22, 2016

http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm481968.htm

Research needed

- Open source medical devices
- Medical device cryptography
- Personal area network monitoring
- Jamming protection
- Forensics evidence capture

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The benefit outweighs the risk

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Credits

Éireann Leverett (@blackswanburst)

Tony Naggs (@xa329)

Gunnar Alendal (@gradoisageek)

Hugo Campos (@HugoOC)

Scott Erven (@scotterven)

Alexandre Dulaunoy (@adulau)

Claus Cramon Houmann (@ClausHoumann)

Joshua Corman (@joshcorman)

Beau Woods (@beauwoods)

Suzanne Schwartz (US FDA)

Family & Friends ❤

I am The Cavalry

Thank you!

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