

EMBODIED VULNERABILITIES - WHY I AM HACKING MY OWN **HEART**

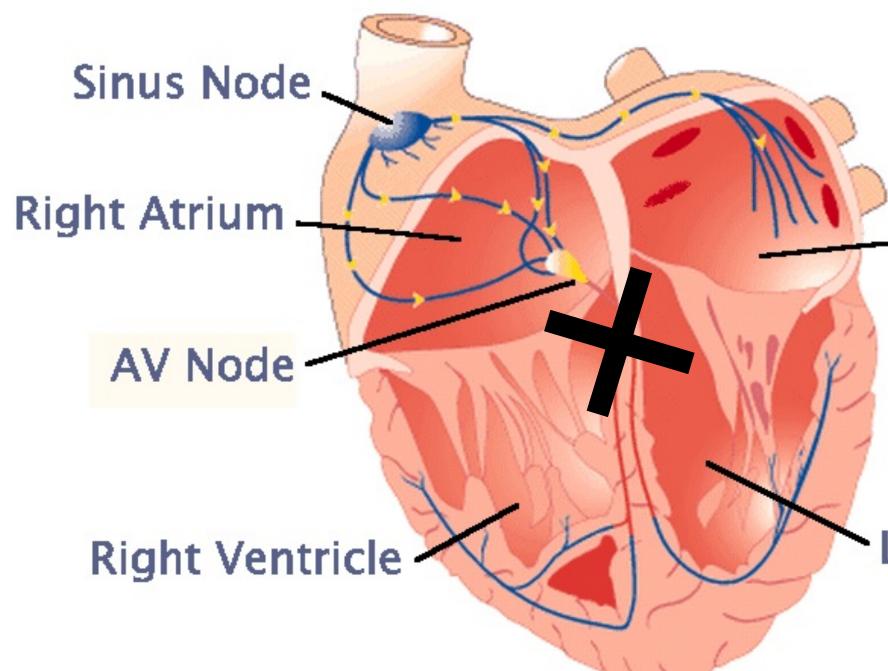
Dr. Marie Moe, SINTEF



@MarieGMoe @SINTEF_Infosec



ELECTRICAL SYSTEM OF THE HEART

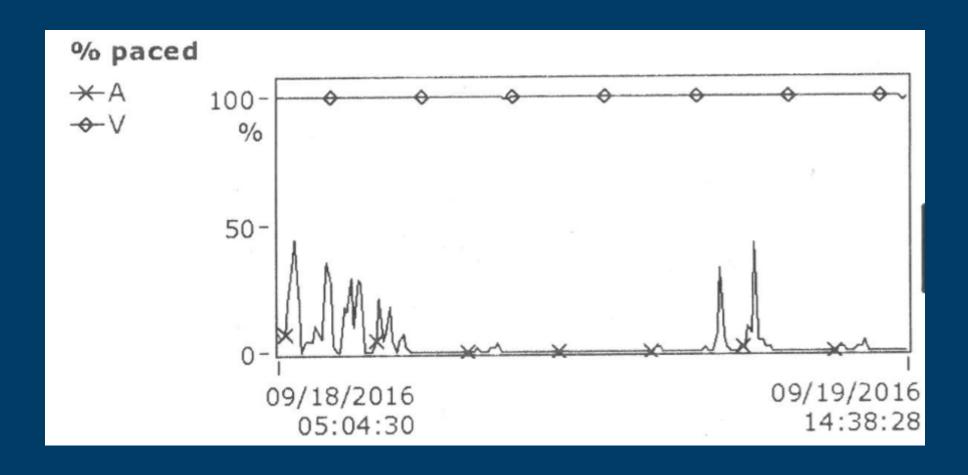


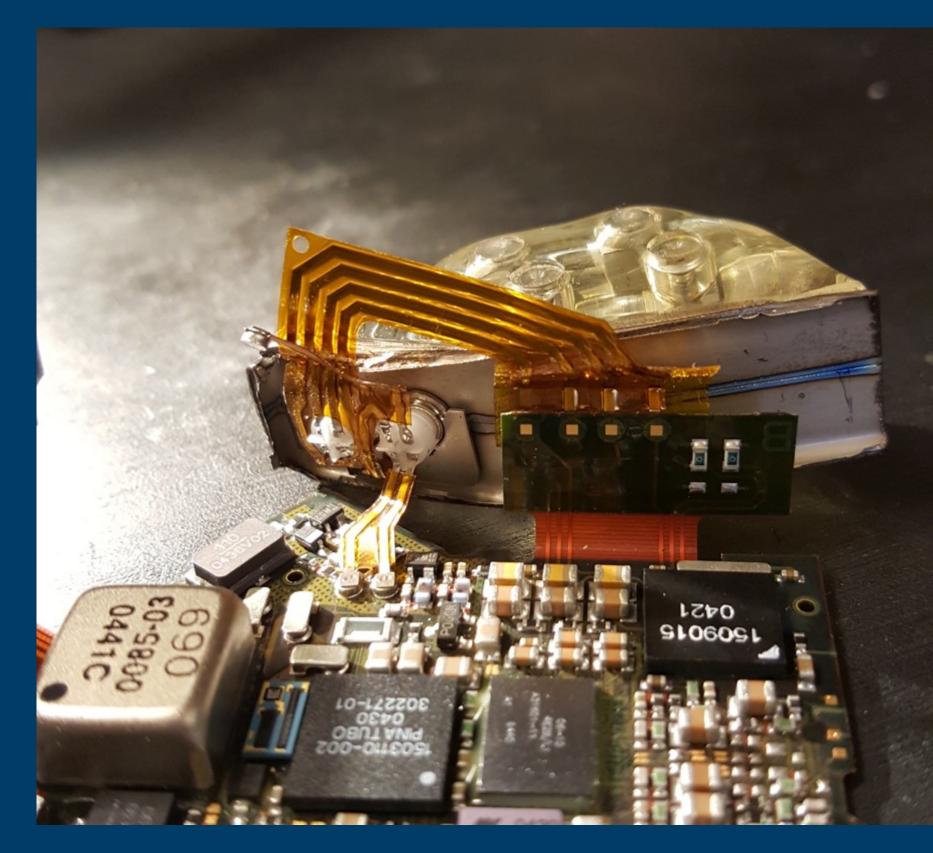
- Left Atrium

Left Ventricle

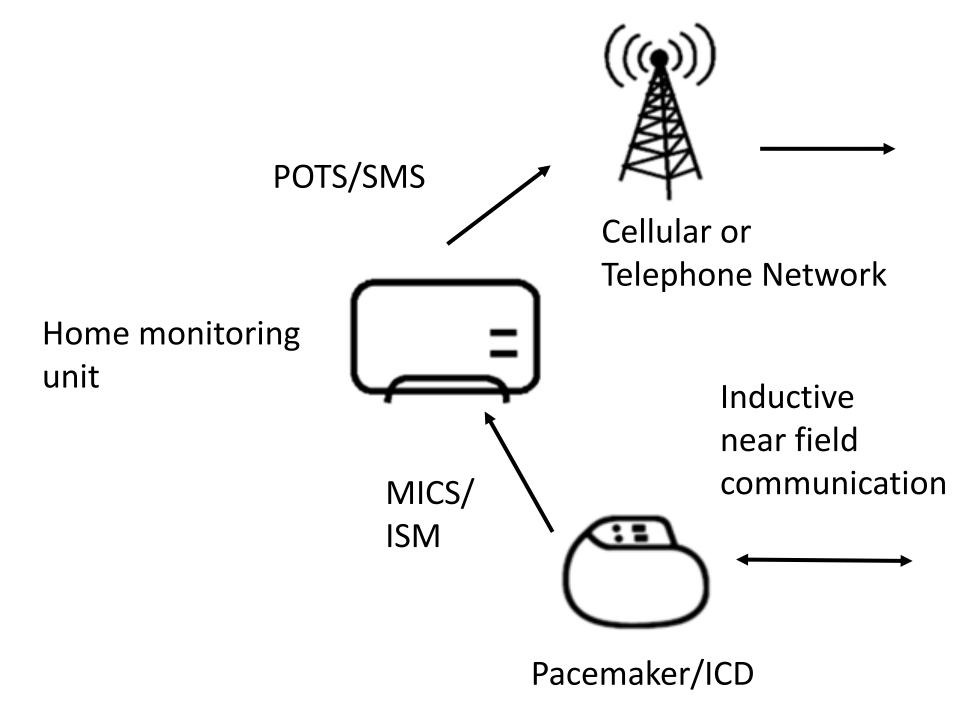


MY LIFE DEPENDS ON THIS HARDWARE AND SOFTWARE





EMBODIED AND CONNECTED







Programmer



WHAT COULD POSSIBLY GO WRONG?

Patient privacy issues

Battery exhaustion

Device malfunction

Death threats and extortion

Remote assassination scenario...



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LOSS OF VISIBILITY IN CONFIGURATION



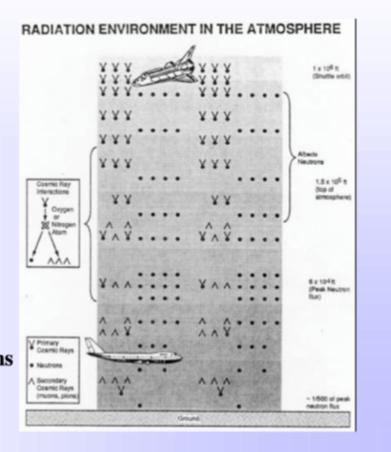
BITFLIP IN THE AIR AND DEBUGGING MY PACEMAKER



Neutron Environment in the Atmosphere

Boeing Radiation Effects Lab

Neutrons, created by cosmic ray interactions with the O₂ and N₂ in the air, peak at ~60,000 ft. At 30,000 ft the neutrons are about 1/3 the peak flux, and on the ground, ~1/400 of the peak flux. The peak flux is ~4 neutron/cm²sec. Other particles such as secondary protons and pions are also created, but for SEU the neutrons are the most important.



Merlin.

1/4/99



DATA ERROR IN PACEMAKER

Na	e Initialize factory settings
	Caution: Possible data error in pacemaker. Device is currently ri ODI at 70 bpm; AV delay 160 ms; Pulse amplitude 4.8 V; Pulse v Al algorithms turned OFF. Tagnet mode: SYNC
M	o resume normal pacemaker function: Select 'Memory dump + re-initialize' button to send the standard This will take several minutes; meanwhile, do not remove the pr



program to the pacemaker. ogrammer head.

unning a backup program: width 1.0 ms;





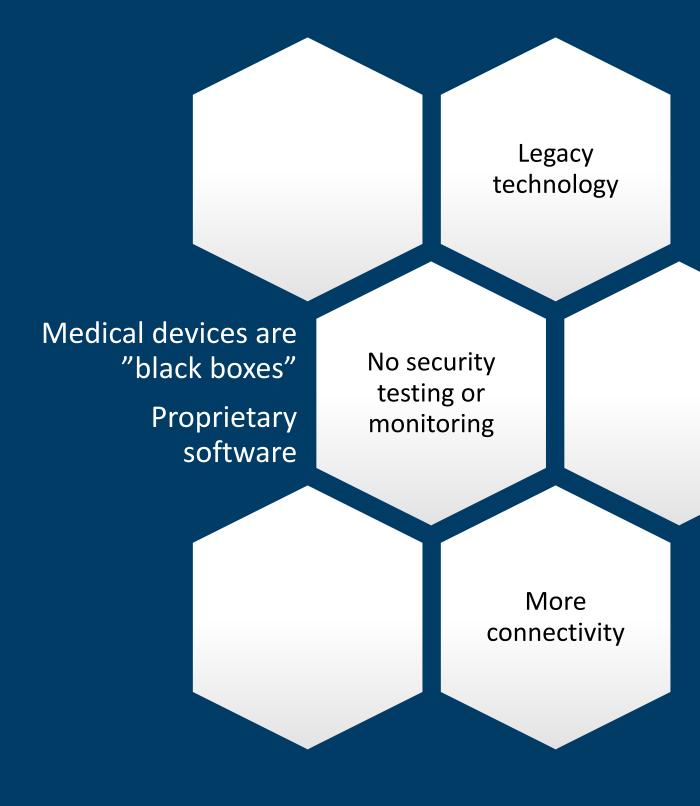
St. Jude stock shorted on heart device hacking fears; shares drop

The stock of pacemaker manufacturer St. Jude Medical Inc (STJ.N) fell sharply on Thursday after short-selling firm Muddy Waters said it had pl...

1 måned 3 måneder 5 år Maks. 1 år 25. aug 26. aug 29. aug



WHY?



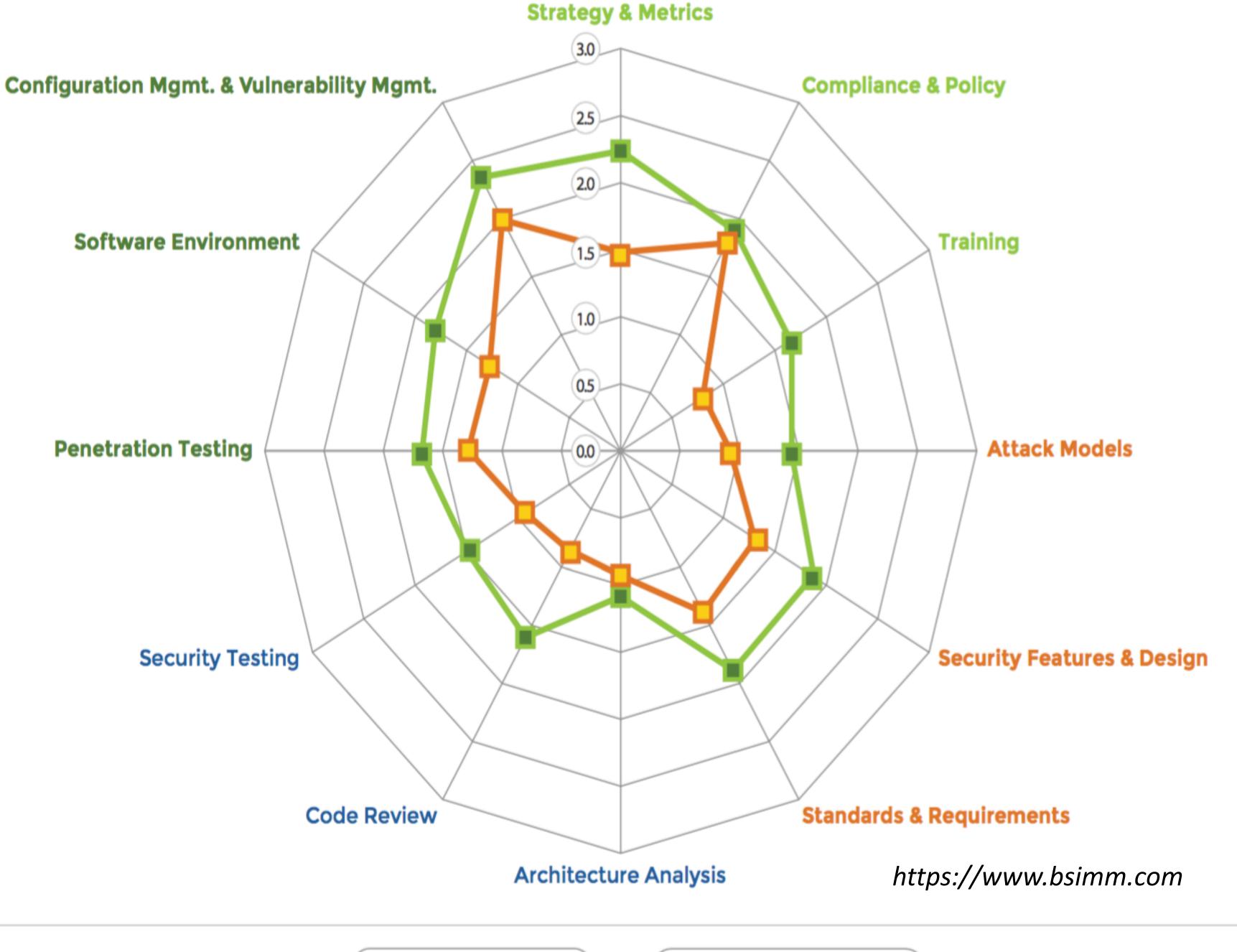
No software updates Long lifetime of devices

Heavy regulations

No security regulations

Increased attack surface

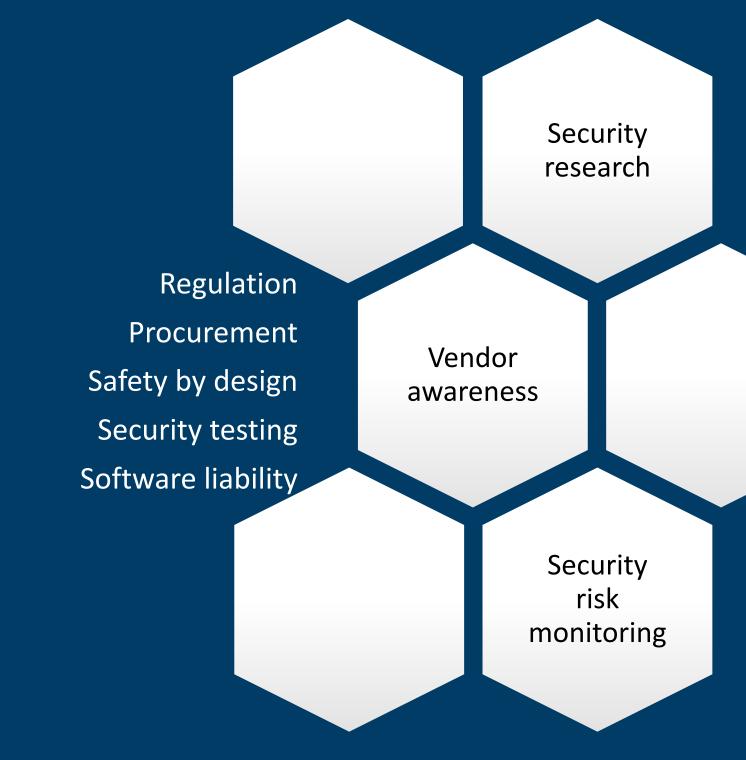






Healthcare (15 of 95)

HOW TO SOLVE IT?



Information sharing

Third party collaboration

Coordinated disclosure

Security updates Software Inventory Incident response Cyber insurance Resilience





MORE RESEARCH NEEDED!

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



THE BENEFIT OUTWEIGHS THE RISK





Technology for a better society

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