

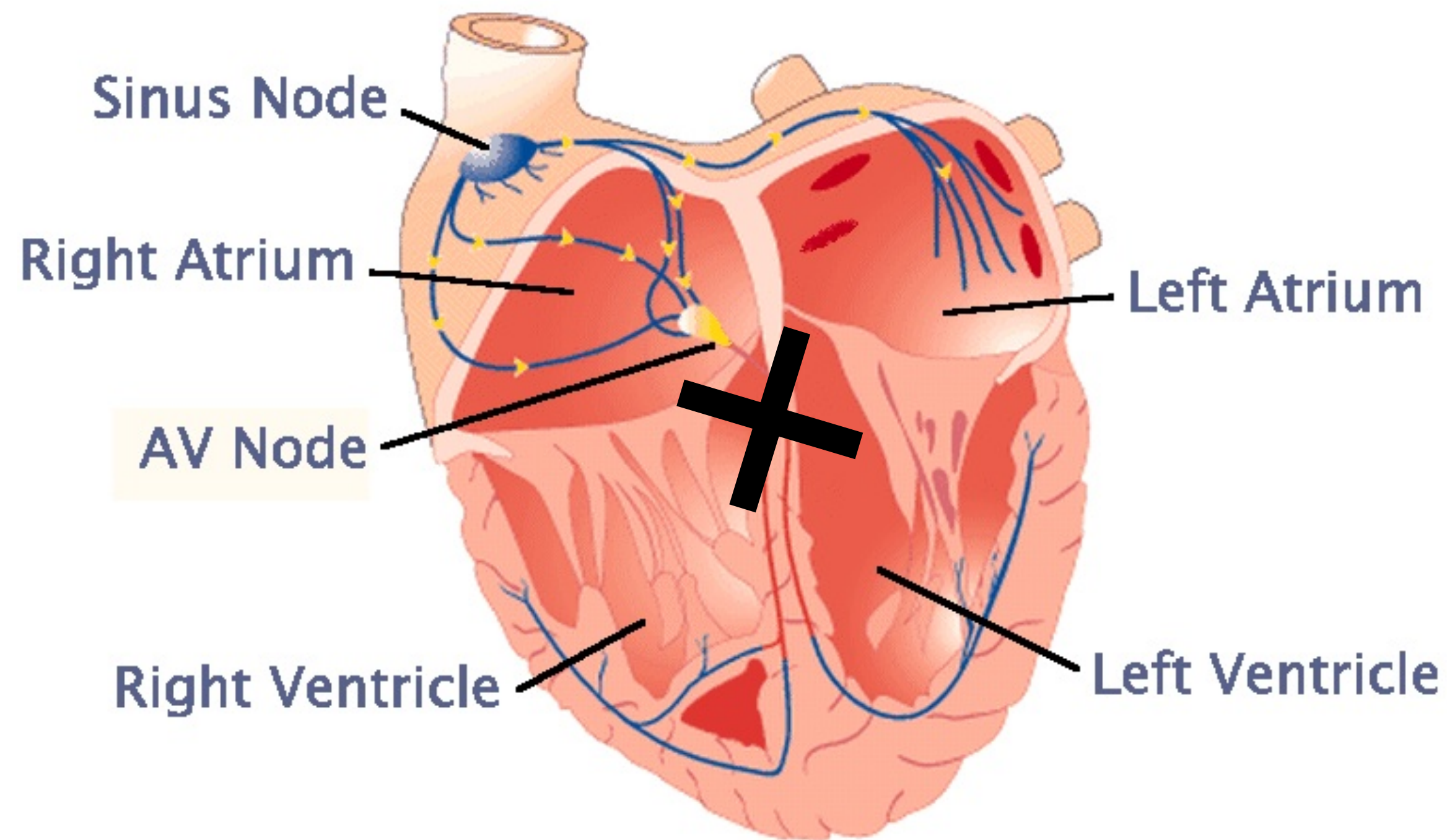


EMBODIED VULNERABILITIES — WHY I AM HACKING MY OWN HEART

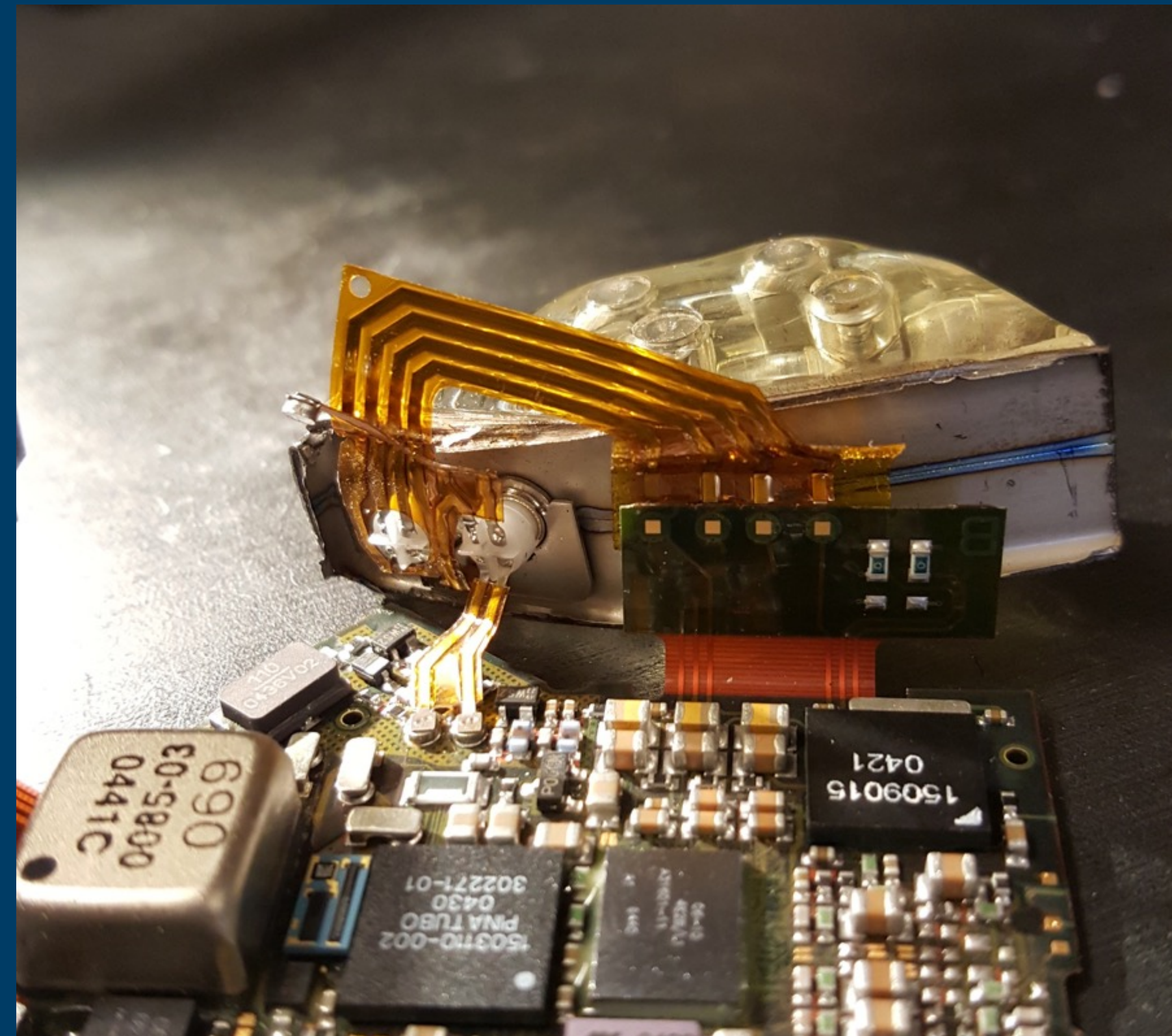
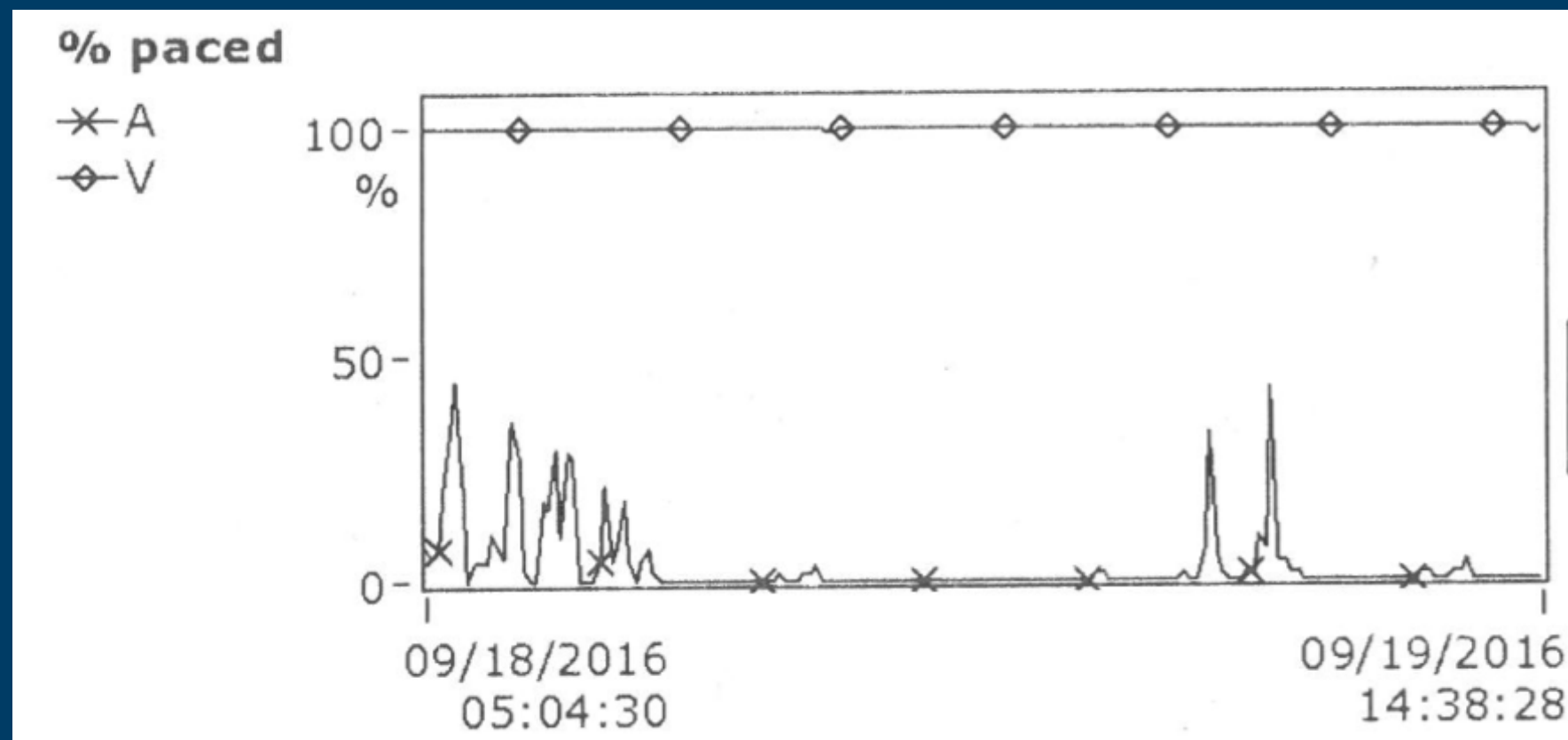
Dr. Marie Moe, SINTEF

 @MarieGMoe @SINTEF_Infosec

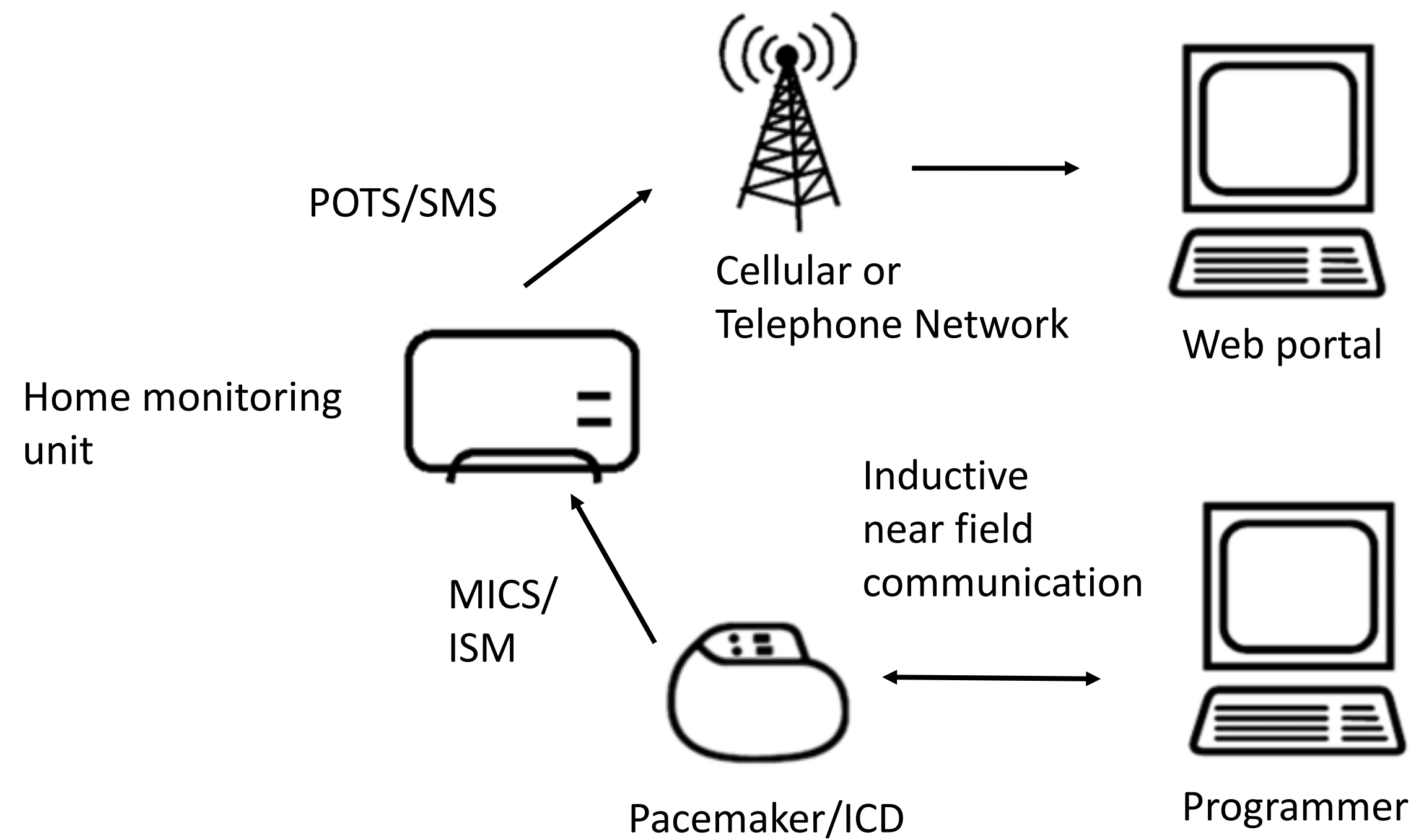
ELECTRICAL SYSTEM OF THE HEART



MY LIFE DEPENDS ON THIS HARDWARE AND SOFTWARE



EMBODIED AND CONNECTED



WHAT COULD POSSIBLY GO WRONG?

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



LOSS OF VISIBILITY IN CONFIGURATION

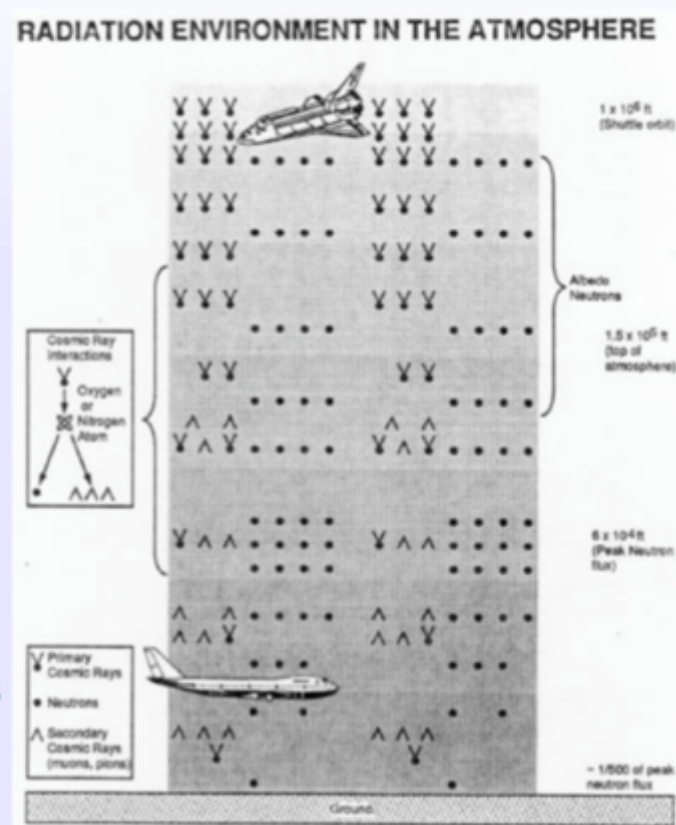
BITFLIP IN THE AIR AND DEBUGGING MY PACEMAKER



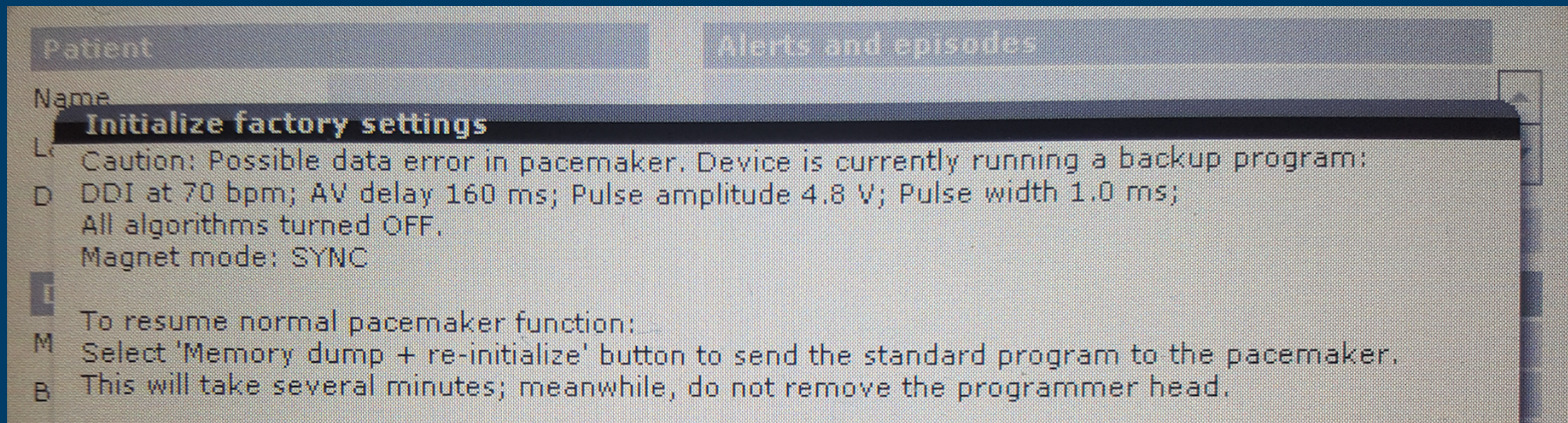
Neutron Environment in the Atmosphere

Boeing Radiation Effects Lab

Neutrons, created by cosmic ray interactions with the O_2 and N_2 in the air, peak at $\sim 60,000$ ft. At $30,000$ ft the neutrons are about $1/3$ the peak flux, and on the ground, $\sim 1/400$ 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.



DATA ERROR IN PACEMAKER



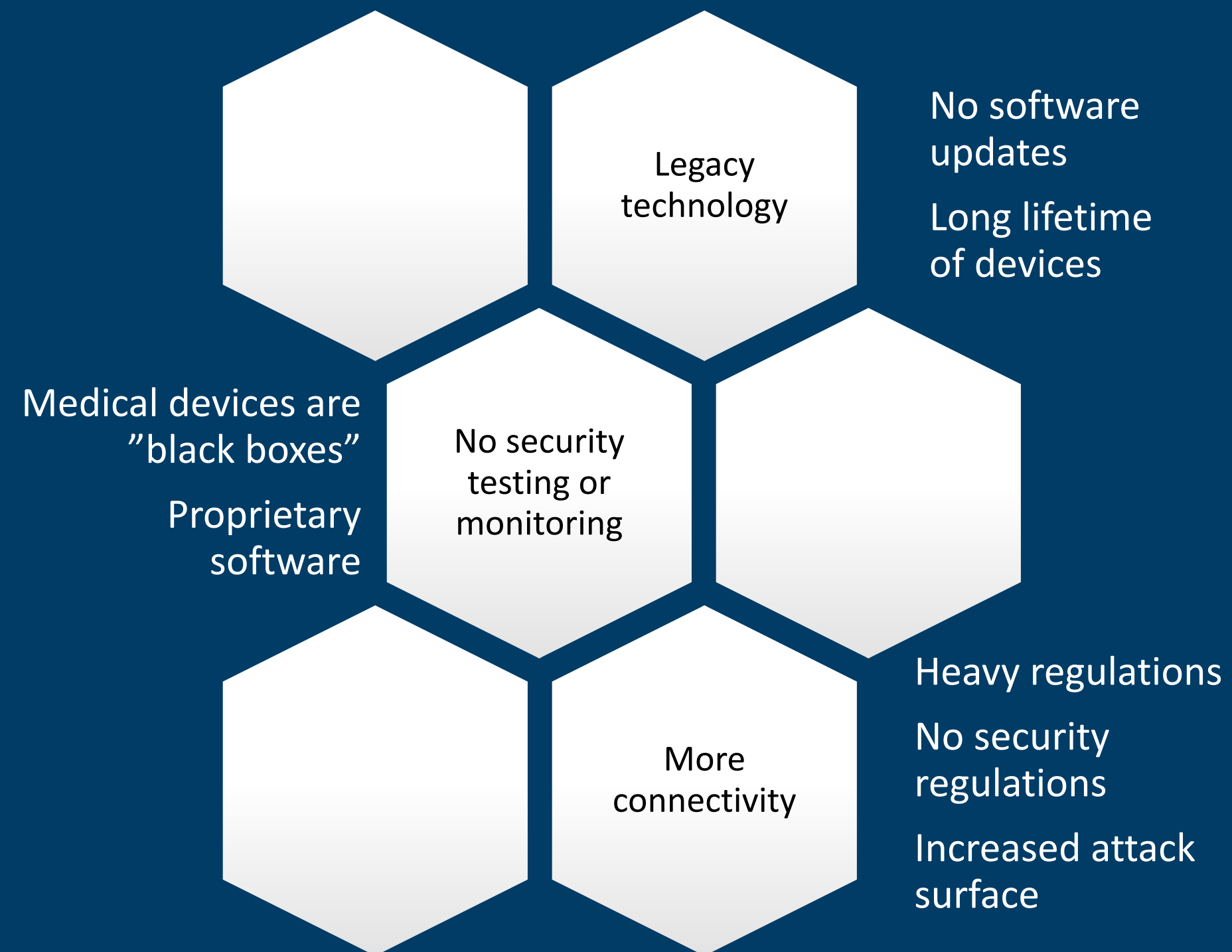


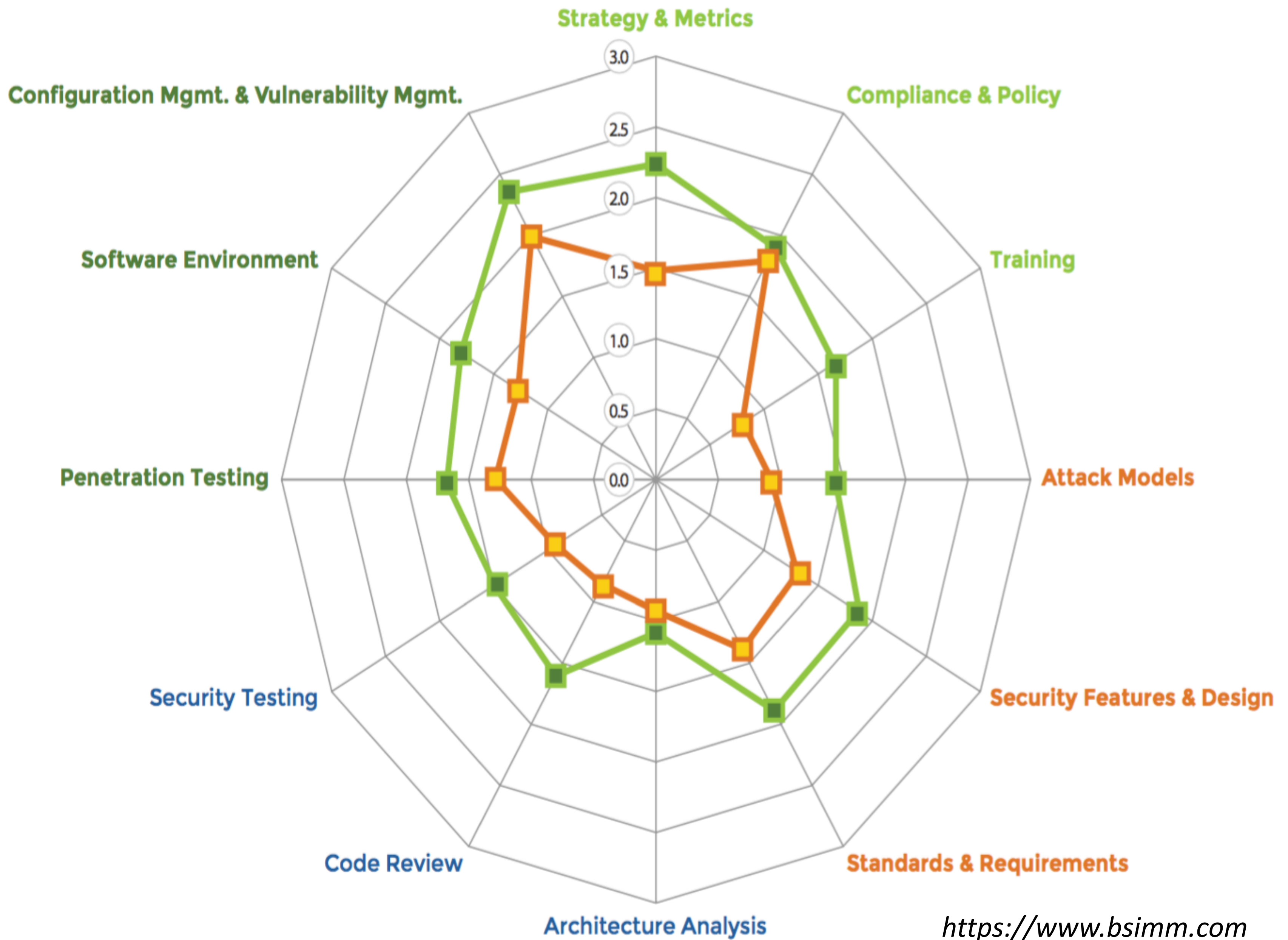


St. Jude stock shorted on heart device hacking fears; shares drop

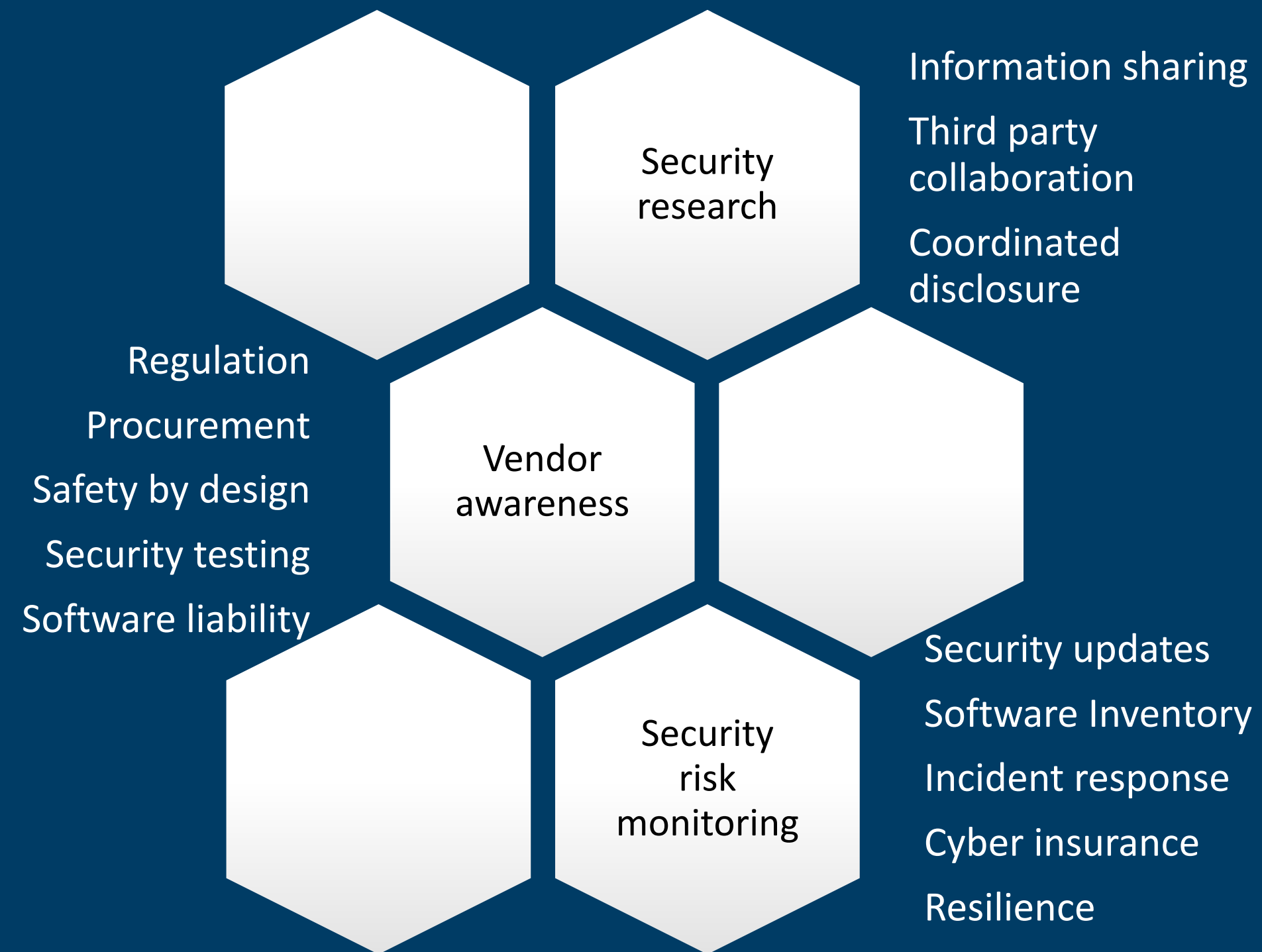
The stock of pacemaker manufacturer St. Jude Medical Inc (STJ.N) fell sharply on Thursday after short-selling firm Muddy Waters said it had pl...

WHY?





HOW TO SOLVE IT?





MORE RESEARCH NEEDED!

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

THE BENEFIT OUTWEIGHS THE RISK





Technology for a better society

marie.moe@sintef.no

 [@MarieGMoe](https://twitter.com/MarieGMoe) [@SINTEF_Infosec](https://twitter.com/SINTEF_Infosec)