Internet of Things

Push of technology requires a push in security

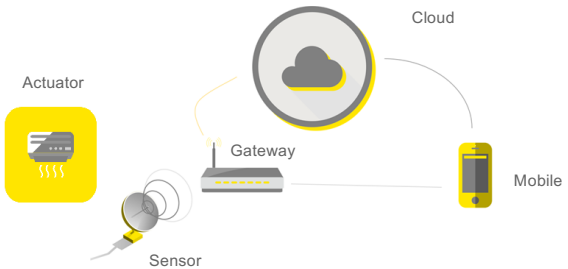
Building a better working world

Who am I?

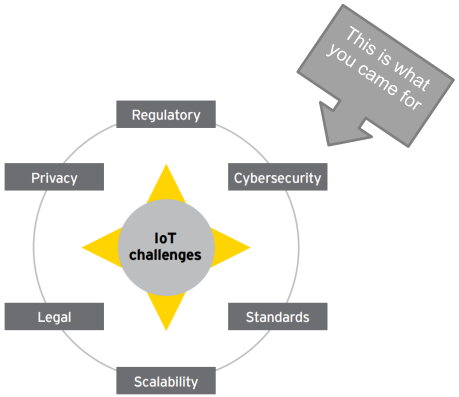
- Lucas Kauffman
- Senior IT Security consultant
- 4 years of experience (3 years in Belgium, 1 in Singapore)
- Contributor to Security Stack Exchange (platform for Q&A on information security)
- I like breaking things
- Beer enthusiast

What is Internet of Things?

> *A proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data.*



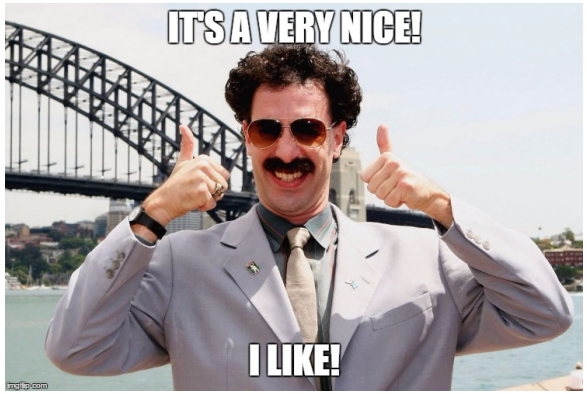
What are the issues with IoT?



Our experience testing IoT

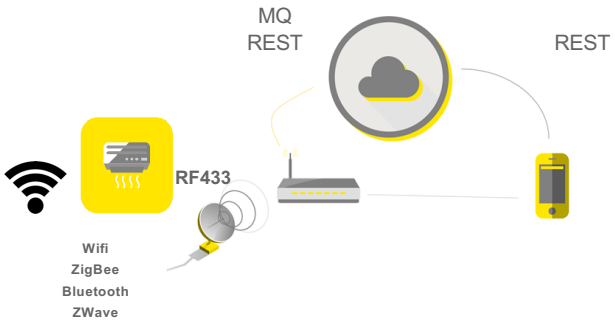
- Vendors both locally and international
- Small and large companies
- Different types of architectures
- All, but two had significant vulnerabilities
- Vulnerabilities keep coming back
- It's not because they don't want to, it's because they don't know.
- But…

But… they want to learn!



So what did we see?

General architecture



Threat vectors: Elderly monitoring

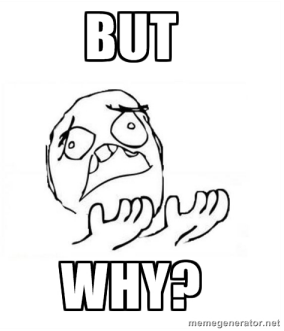
- Gateways used as botnet
- Mass surveillance of users
- Individual surveillance (theft)
- Disruption of service (fake emergency alerts)
- Spoofed telemetry
- Abuse of signals to cause fire
- …

High impact vulnerabilities

Unauthenticated internet facing update mechanisms	▸ Remote code execution ▸ Used together with another vulnerability to enumerate all gateways on the internet ▸ Automated exploitation of all box
SQL/JSON Injection on a "cloud" web interface	▸ Retrieve medical and activity data of subjects ▸ Retrieve personal data of subjects including addresses ▸ Using addresses and activity data (we know when someone is not home)
Bad design	▸ Backend was able execute commands on all routers ▸ Mobile applications log on to database directly ▸ Commands are sent using clear text and unsigned MQ messages
Don't trust anyone	▸ Too much reliant on the network security ▸ Gateway is trusted (e.g. no input validation on data pushed by the gateway)

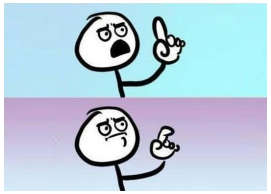
Old friends

- SQL Injection
- Cross Site Scripting
- CSRF
- Bad crypto/clear text communication
- Bad password hashing algorithms
- Command injection
- No patching
- Bad authentication
- Direct backend resource access



Why?

- Start up companies must have a functional prototype
- Focus is on features and functionality, not security
- Limited experience
- Security takes time
- Security is hard to get right
- IoT does not have a lot of reference architectures or standards
- No budget for security reviews



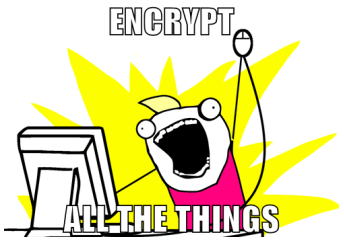
So how do we tackle these things?

We need security by design and reference architectures

- A single component should not be able to compromise another component
- Component communication should be encrypted
- All communication should be authenticated (Don't trust anyone!)
- Do proper threat modeling
- Be flexible!
- Don't think "they will never find out" (because we will)

Encryption

- Encrypt all communication
- Authenticate all communication
- Use standards
- Cryptography is hard, so don't roll your own
- Don't fail open or fallback



Validate input and use proper output encoding

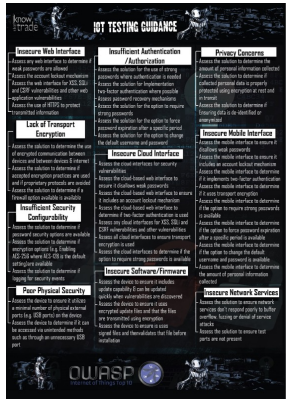
- Don't trust any input coming from the user:
  - Mobile device
  - Gateway
  - Sensors
- Do strict validation
- Whitelist is better than blacklist
- Use vetted frameworks for application development

But most importantly… awareness

IoT Project

Attack Surface Areas

Testing Guide | Top Vulnerabilities



But most importantly… awareness

- Doing IoT security at security conferences will show security to those interested in security
  - These are generally not the people who end up making mistakes
- We need to take security to general IoT conferences, meetups, etc…
- 15 minute slots with a brief awareness overview
- Make them aware and enthusiastic about security!

Summary

- People want to attach everything to the Internet (and they're not taking care of security)
- Mistakes are made due to security objectives being less important than business objectives
- There is a lack of awareness with regard to security
- We need more standards, good examples and reference architectures
- We need to take it to their communities

Q&A

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