What someone said about “junk hacking”

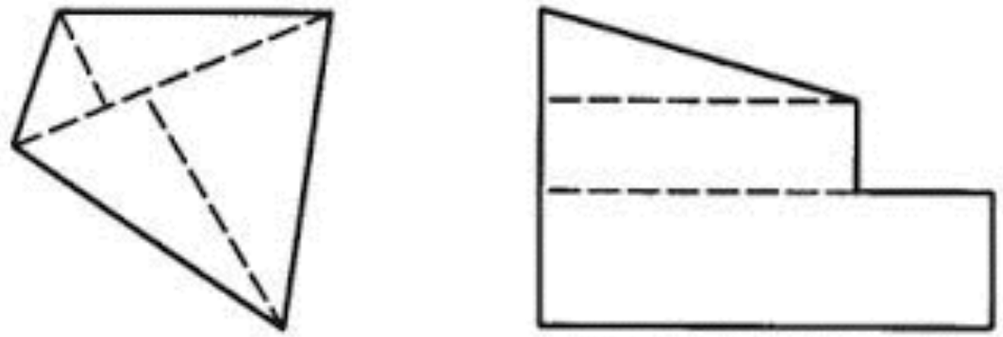
> Yes, we get it. Cars, boats, buses, and those singing fish plaques are all hackable and have no security. **Most conferences these days have a whole track called "Junk I found around my house and how I am going to scare you by hacking it"**. That stuff is always going to be hackable whetherornotyouarethecalvalry.org.

. . .

> **So in any case, enough with the Junk Hacking**, and enough with being amazed when people hack their junk.

IoT Attack Surface Mapping

Seeking a universal, surface-area approach to IoT testing



Daniel Miessler
IoT Village, DEFCON 23
August 2015

Junk Hacking and Vuln Shaming

Yes, we get it. Cars, boats, buses, and those singing fish plaques are all hackable and have no security. **Most conferences these days have a whole track called "Junk I found around my house and how I am going to scare you by hacking it"**. That stuff is always going to be hackable whetherornotyouarethecalvalry.org.

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So in any case, enough with the Junk Hacking, and enough with being amazed when people hack their junk.

What's in a name?

- Universal Daemonization
- Universal Object Interaction
- Programmable Object Interfaces (POIs)
- Transfurigated Phase Inversion

Defining IoT

- [WIKIPEDIA] The Internet of Things (IoT) is the **network of physical objects or "things" embedded with electronics, software, sensors and connectivity** to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices.

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

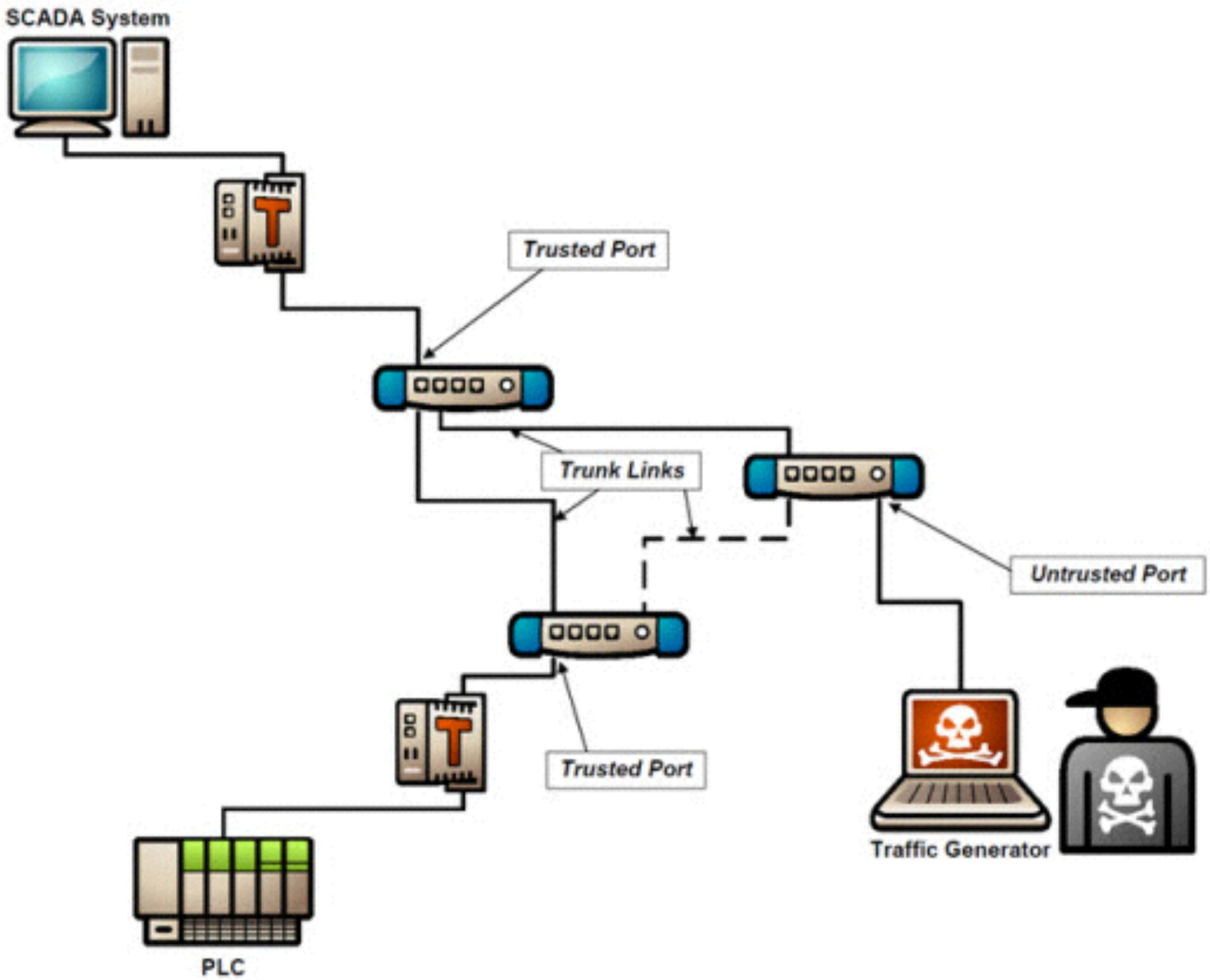
- [MY PREFERRED] **The interface between the physical and digital world that allows one to gather information from—and control—everyday objects.**

What to do?

What to do?

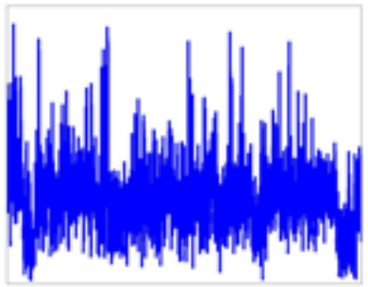
What to do?

What to do?

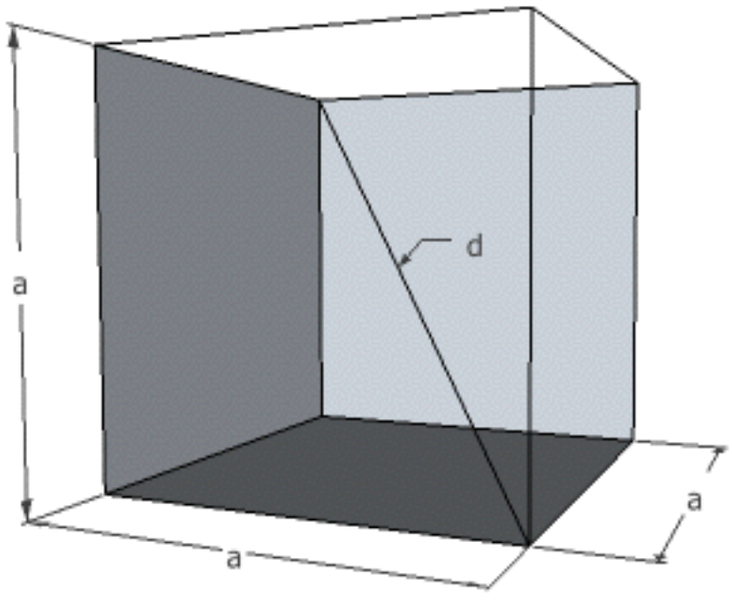

SCADA System
Trusted Port
Trunk Links
Untrusted Port
Trusted Port
Traffic Generator
PLC

What to do?

IoT Security != Device Security



IoT Device



Existing approaches…

- Look at a collection of common vulnerabilities, risks, etc.
- Pull up your go-to list
- Consider some bad scenarios
- Check for what others have found on other devices

OWASP

Top 10 Risks

OWASP Mobile Top 10 Risks	
M1- Insecure Data Storage	M6- Improper Session Handling
M2- Weak Server Side Controls	M7- Security Decisions Via Untrusted Inputs
M3- Insufficient Transport Layer Protection	M8- Side Channel Data Leakage
M4- Client Side Injection	M9- Broken Cryptography
M5- Poor Authorization and Authentication	M10- Sensitive Information Disclosure

The Previous Version

- Used the Top 10 name
- Mixed surfaces with vulnerability types

New OWASP IoT Project Structure

IoT Project

Attack Surface Areas

Testing Guide

Top Vulnerabilities

Subtle differences in approach

Different approaches to finding vulns

1. Let me check against this list of vulns

Different approaches

1. Let me check against this list of vulns.

2. Let me check my favorite go-to issues

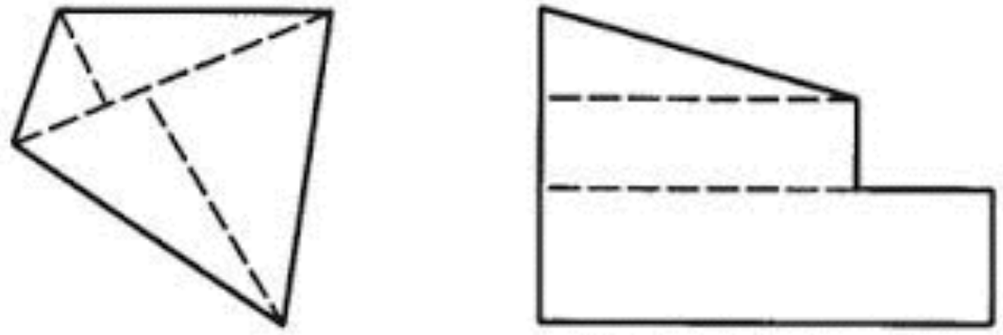
Different approaches

1. Let me check against this list of vulns.

2. Let me check my favorite go-to issues

3. What common surface areas do IoT systems share that I need to make sure I don't miss?

The IoT Attack Surfaces



Ecosystem Access Control

Ecosystem Access Control

- ✓ Authentication
- ✓ Session management
- ✓ Implicit trust between components
- ✓ Enrollment security
- ✓ Decomissioning system
- ✓ Lost access procedures

Device Memory

- ✓ Cleartext usernames
- ✓ Cleartext passwords
- ✓ Third-party credentials
- ✓ Encryption keys

Device Physical Interfaces

Device Physical Interfaces

- ✓ Firmware extraction
- ✓ User CLI
- ✓ Admin CLI
- ✓ Privilege escalation
- ✓ Reset to insecure state

Device Web Interface

Device Web Interface

- ✓ SQL injection
- ✓ Cross-site scripting
- ✓ Username enumeration
- ✓ Weak passwords
- ✓ Account lockout
- ✓ Known credentials

Device Firmware

DEVICE FIRMWARE

- ✓ Hardcoded passwords
- ✓ Sensitive URL disclosure
- ✓ Encryption keys

Device Network Services

Device Network Services

- ✓ Information disclosure
- ✓ User CLI
- ✓ Administrative CLI
- ✓ Injection
- ✓ Denial of Service

Administrative Interface

- ✓ SQL injection
- ✓ Cross-site scripting
- ✓ Username enumeration
- ✓ Weak passwords
- ✓ Account lockout
- ✓ Known credentials

Local Data Storage

- ✓ Unencrypted data
- ✓ Data encrypted with discovered keys
- ✓ Lack of data integrity checks

Cloud Web Interface

- ✓ SQL injection
- ✓ Cross-site scripting
- ✓ Username enumeration
- ✓ Weak passwords
- ✓ Account lockout
- ✓ Known credentials

Third-party Backend APIs

Third-party Backend APIs

- ✓ Unencrypted PII sent
- ✓ Encrypted PII sent
- ✓ Device information leaked
- ✓ Location leaked

Update Mechanism

- ✓ Update sent without encryption
- ✓ Updates not signed
- ✓ Update location writable

Mobile Application

- ✓ Implicitly trusted by device or cloud
- ✓ Known credentials
- ✓ Insecure data storage
- ✓ Lack of transport encryption

Vendor Backend APIs

Vendor Backend APIs

- ✓ Inherent trust of cloud or mobile application
- ✓ Weak authentication
- ✓ Weak access control
- ✓ Injection attacks

Ecosystem Communication

- ✓ Health checks
- ✓ Heartbeats
- ✓ Ecosystem commands
- ✓ Deprovisioning
- ✓ Update pushes

Network Traffic

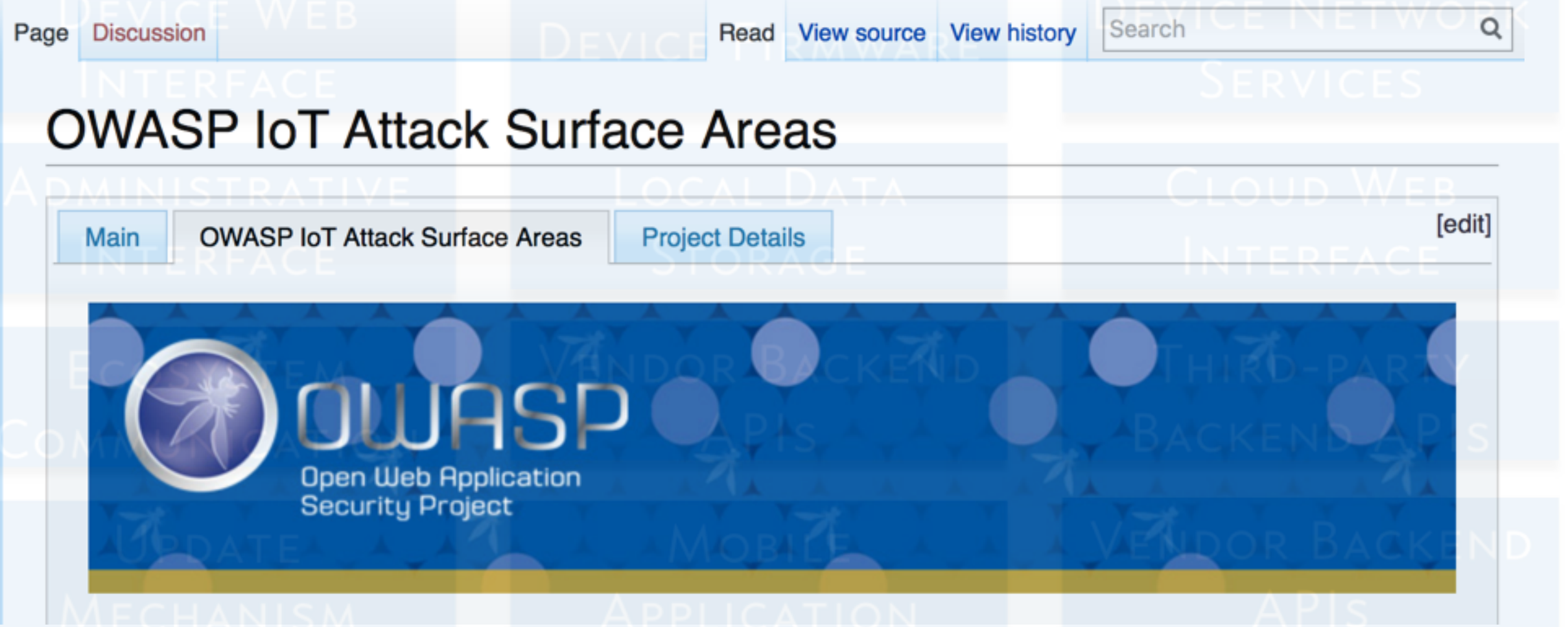
- ✓ LAN
- ✓ LAN to Internet
- ✓ Short range
- ✓ Non-standard

IoT Attack Surface Areas

Ecosystem Access Control	Device Memory	Device Physical Interfaces
Device Web Interface	Device Firmware	Device Network Services
Administrative Interface	Local Data Storage	Cloud Web Interface
Ecosystem Communication	Vendor Backend APIs	Third-party Backend APIs
Update Mechanism	Mobile Application	Vendor Backend APIs
Network Traffic		

The OWASP IoT Attack Surfaces Project

https://www.owasp.org/index.php/OWASP_IoT_Attack_Surface_Areas



Surfaces → vulns → data

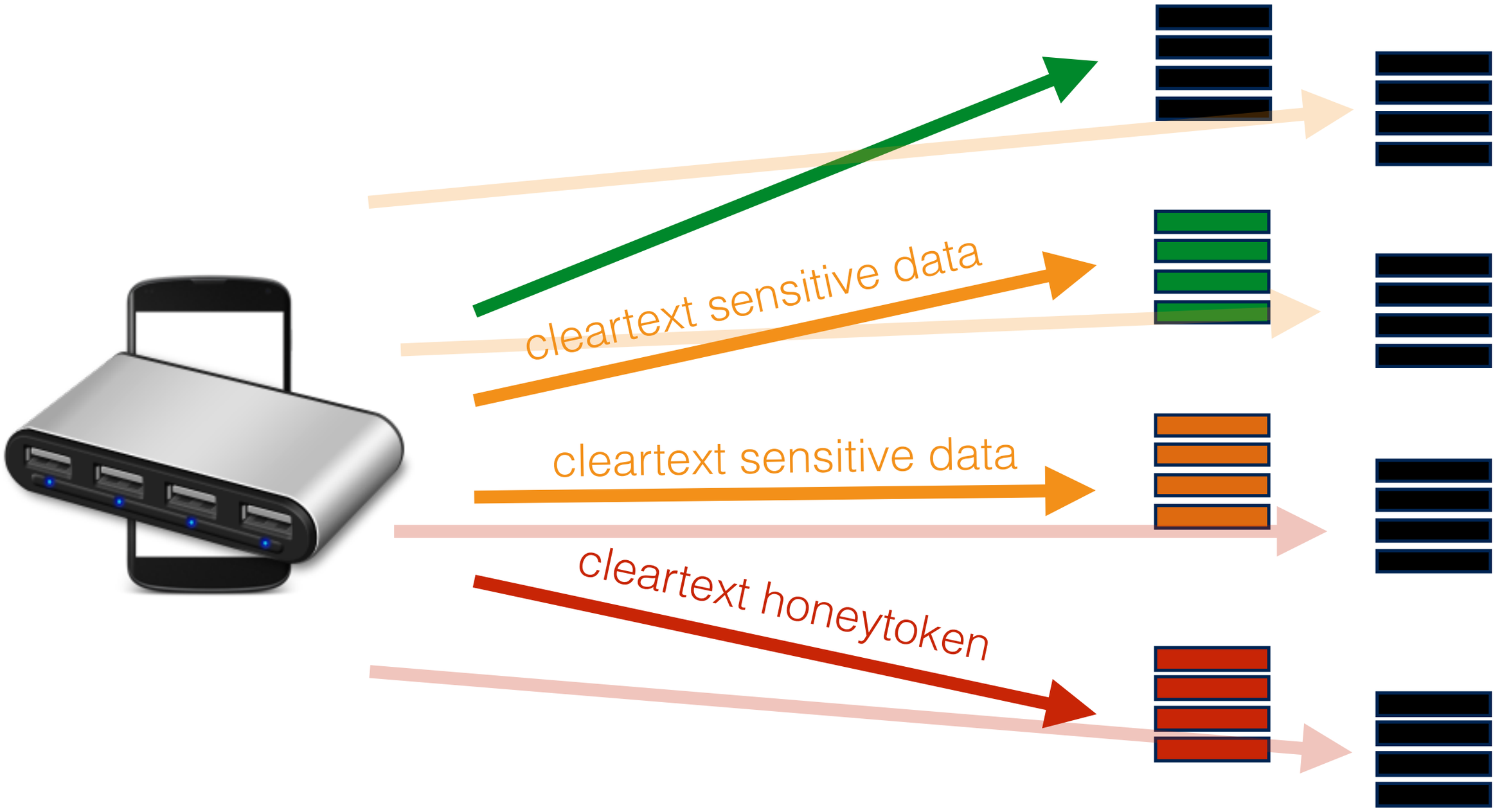
Attack Surface	Vulnerability	Data Type
• Administrative interface	• Weak password policy • Lack of account lockout	• Credentials
• Local data storage	• Data stored without encryption	• PII
• Web Cloud Interface	• SQLi	• PII • Account data
• Device Firmware	• Sent over HTTP • Hardcoded passwords • Hardcoded encryption keys	• Credentials • Application data
• Vendor Backend APIs	• Permissive API Data Extraction	• PII • Account data
• Device Physical Interfaces	• Unauthenticated root access	• ***

Back to the network…

- ✓ LAN
- ✓ LAN to Internet
- ✓ Short range
- ✓ Non-standard

What people think they have

What people actually have



What I like to look for in pcaps

1. How many connections were made?
2. To how many destinations?
3. Was the sensitive data I entered into the ecosystem seen in the network traffic?
4. If so, that's bad

A quick and dirty PCAP parser that helps you identify who your applications are sending sensitive data to without encryption. — Edit

README.md

caparser

A quick and dirty PCAP parser created to assist network traffic analysis in IoT and Mobile security assessments, *caparse* shows you where your applications are sending cleartext sensitive data.

Getting your capz

Dualcomm DCGS-2005L 10/100/1000Base-T Gigabit Network TAP (Plastic Case)

by Dualcomm

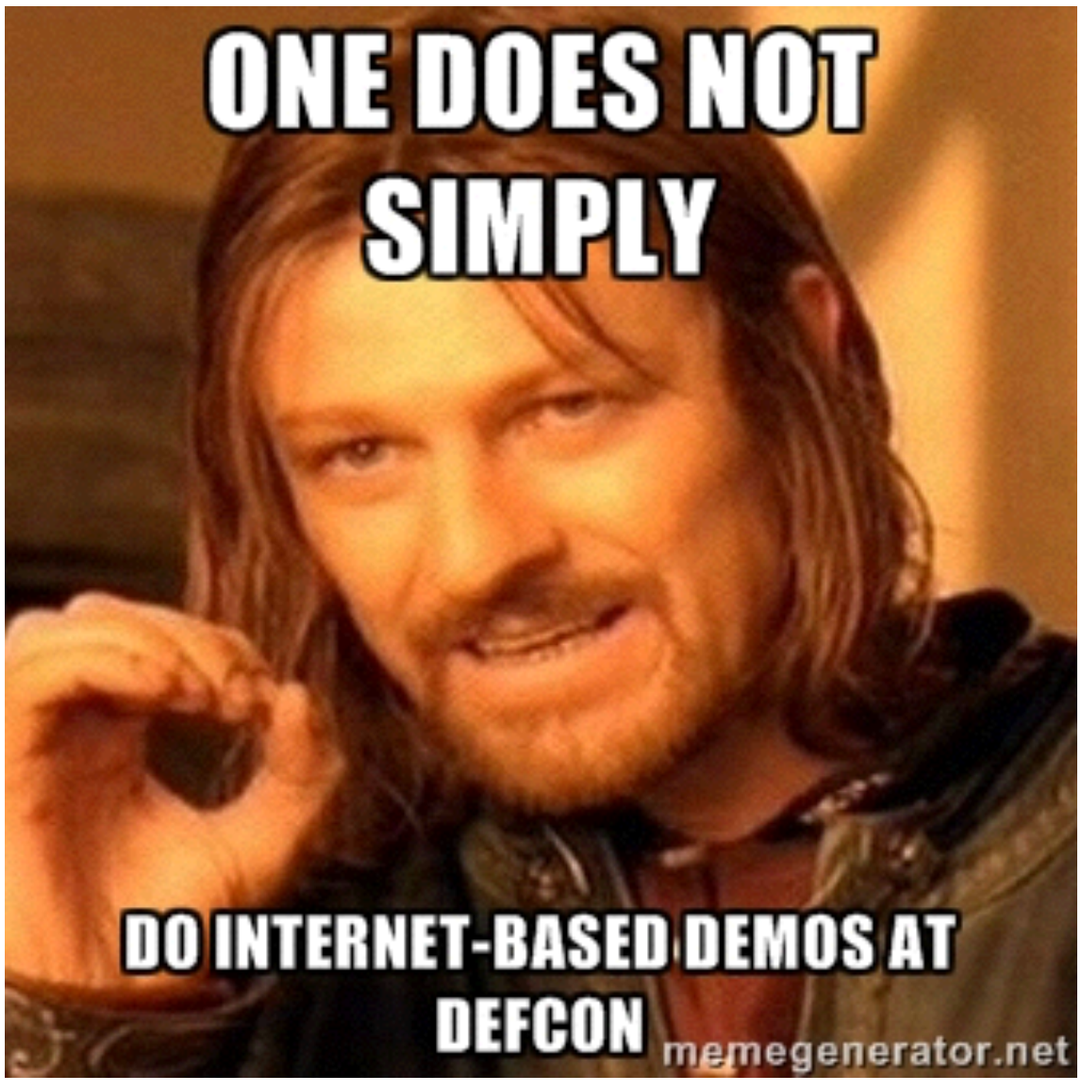
13 customer reviews | 5 answered questions

Price: $179.95 Prime | FREE One-Day

Only 13 left in stock.

Sold by Dualcomm and Fulfilled by Amazon. Gift-wrap available.

- USB Powered Gigabit Network Tap
- PoE Inline Power Pass-Through
- Also function as a 5-Port Gigabit Ethernet Switch
- No Software Configuration Needed. Plug & Play
- Portable.


ONE DOES NOT
SIMPLY
DO INTERNET-BASED DEMOS AT
DEFCON
memegenerator.net

```
daniel at evolus in ~/Development/caparser (master●●)
$
```

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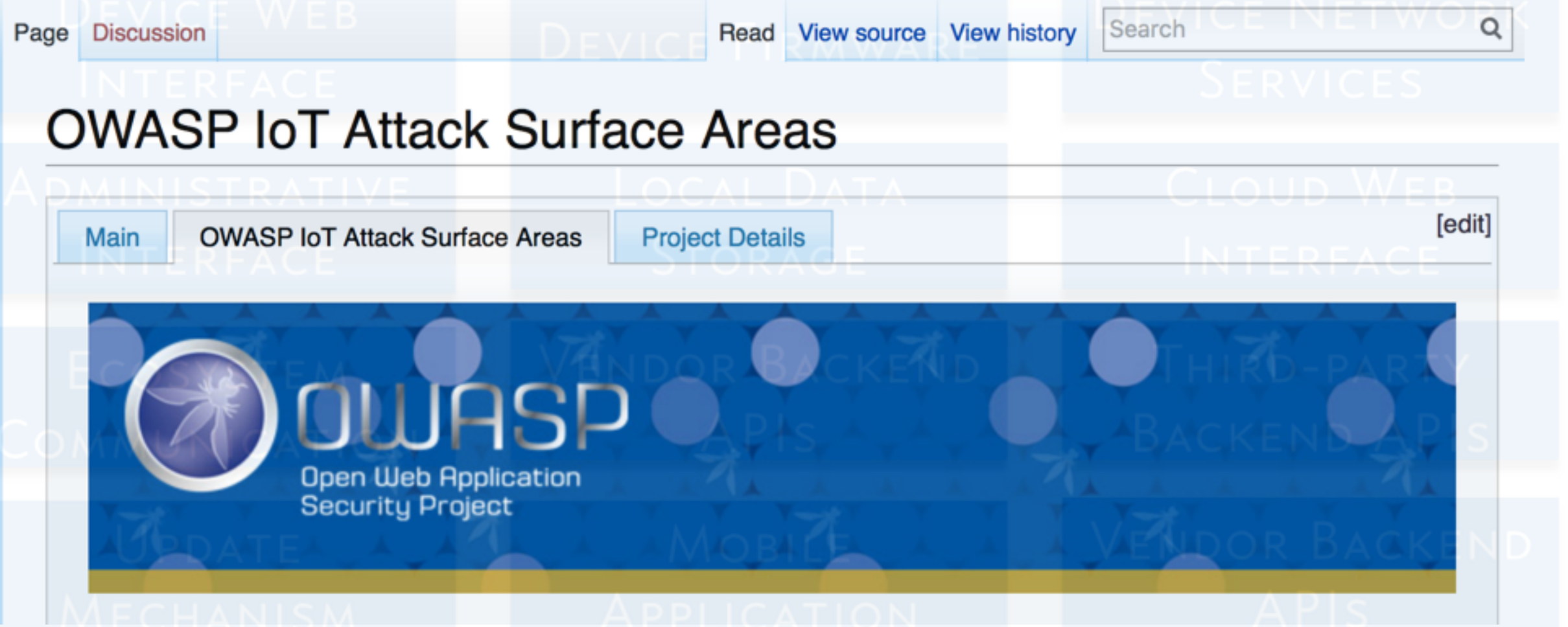

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Sister projects

I Am The Cavalry

BUILDITSECURE.LY

This is a Craig Smith Slide

Craig Smith

Takeaways and Goodies

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8. **There's a handout!**

know the trade

IOT TESTING GUIDANCE

Insecure Web Interface

- Assess any web interface to determine if weak passwords are allowed
- Assess the account lockout mechanism
- Assess the web interface for XSS, SQLi and CSRF vulnerabilities and other web application vulnerabilities
- Assess the use of HTTPS to protect transmitted information

Lack of Transport Encryption

- Assess the solution to determine the use of encrypted communication between devices and between devices & internet
- Assess the solution to determine if accepted encryption practices are used and if proprietary protocols are avoided
- Assess the solution to determine if a firewall option available is available

Insufficient Security Configurability

- Assess the solution to determine if password security options are available
- Assess the solution to determine if encryption options (e.g. Enabling AES-256 where AES-128 is the default setting)are available
- Assess the solution to determine if logging for security events

Poor Physical Security

- Assess the device to ensure it utilizes a minimal number of physical external ports (e.g. USB ports) on the device
- Assess the device to determine if it can be accessed via unintended methods such as through an unnecessary USB port

Insufficient Authentication /Authorization

- Assess the solution for the use of strong passwords where authentication is needed
- Assess the solution for Implementation two-factor authentication where possible
- Assess password recovery mechanisms
- Assess the solution for the option to require strong passwords
- Assess the solution for the option to force password expiration after a specific period
- Assess the solution for the option to change the default username and password

Insecure Cloud Interface

- Assess the cloud interfaces for security vulnerabilities
- Assess the cloud-based web interface to ensure it disallows weak passwords
- Assess the cloud-based web interface to ensure it includes an account lockout mechanism
- Assess the cloud-based web interface to determine if two-factor authentication is used
- Assess any cloud interfaces for XSS, SQLi and CSRF vulnerabilities and other vulnerabilities
- Assess all cloud interfaces to ensure transport encryption is used
- Assess the cloud interfaces to determine if the option to require strong passwords is available

Insecure Software/Firmware

- Assess the device to ensure it includes update capability & can be updated quickly when vulnerabilities are discovered
- Assess the device to ensure it uses encrypted update files and that the files are transmitted using encryption
- Assess the device to ensure is uses signed files and thenvalidates that file before installation

Privacy Concerns

- Assess the solution to determine the amount of personal information collected
- Assess the solution to determine if collected personal data is properly protected using encryption at rest and in transit
- Assess the solution to determine if Ensuring data is de-identified or anonymized

Insecure Mobile Interface

- Assess the mobile interface to ensure it disallows weak passwords
- Assess the mobile interface to ensure it includes an account lockout mechanism
- Assess the mobile interface to determine if it implements two-factor authentication
- Assess the mobile interface to determine if it uses transport encryption
- Assess the mobile interface to determine if the option to require strong passwords is available
- Assess the mobile interface to determine if the option to force password expiration after a specific period is available
- Assess the mobile interface to determine if the option to change the default username and password is available
- Assess the mobile interface to determine the amount of personal information collected

Insecure Network Services

- Assess the solution to ensure network services don't respond poorly to buffer overflow, fuzzing or denial of service attacks
- Assess the solution to ensure test ports are not present

OWASP

Internet of Things Top 10

IoT VILLAGE DEFCON

Thank you!

The OWASP IoT Attack Surfaces Project

https://www.owasp.org/index.php/OWASP_Internet_of_Things_Project

Caparser

https://github.com/danielmiessler/caparser

@danielmiessler

@craigz28

TX to HP Fortify on Demand