

What someone said about “junk hacking”



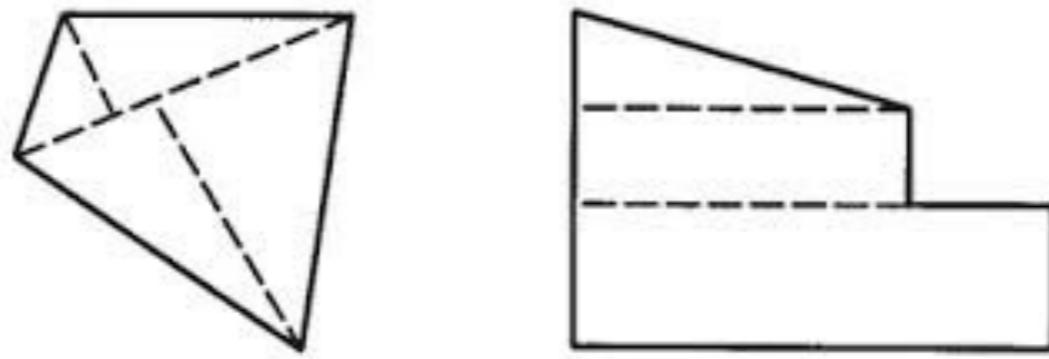
Yes, we get it. Cars, boats, buses, and those singing fish plaques are all hackable and have no security. **Most conferences these days have a whole track called "Junk I found around my house and how I am going to scare you by hacking it".** That stuff is always going to be hackable
whetherornotyouarethecalvalry.org.

...

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



Junk Hacking and Vuln Shaming



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What's in a name?

- ◆ Universal Daemonization
- ◆ Universal Object Interaction
- ◆ Programmable Object Interfaces (POIs)
- ◆ Transfurred 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?



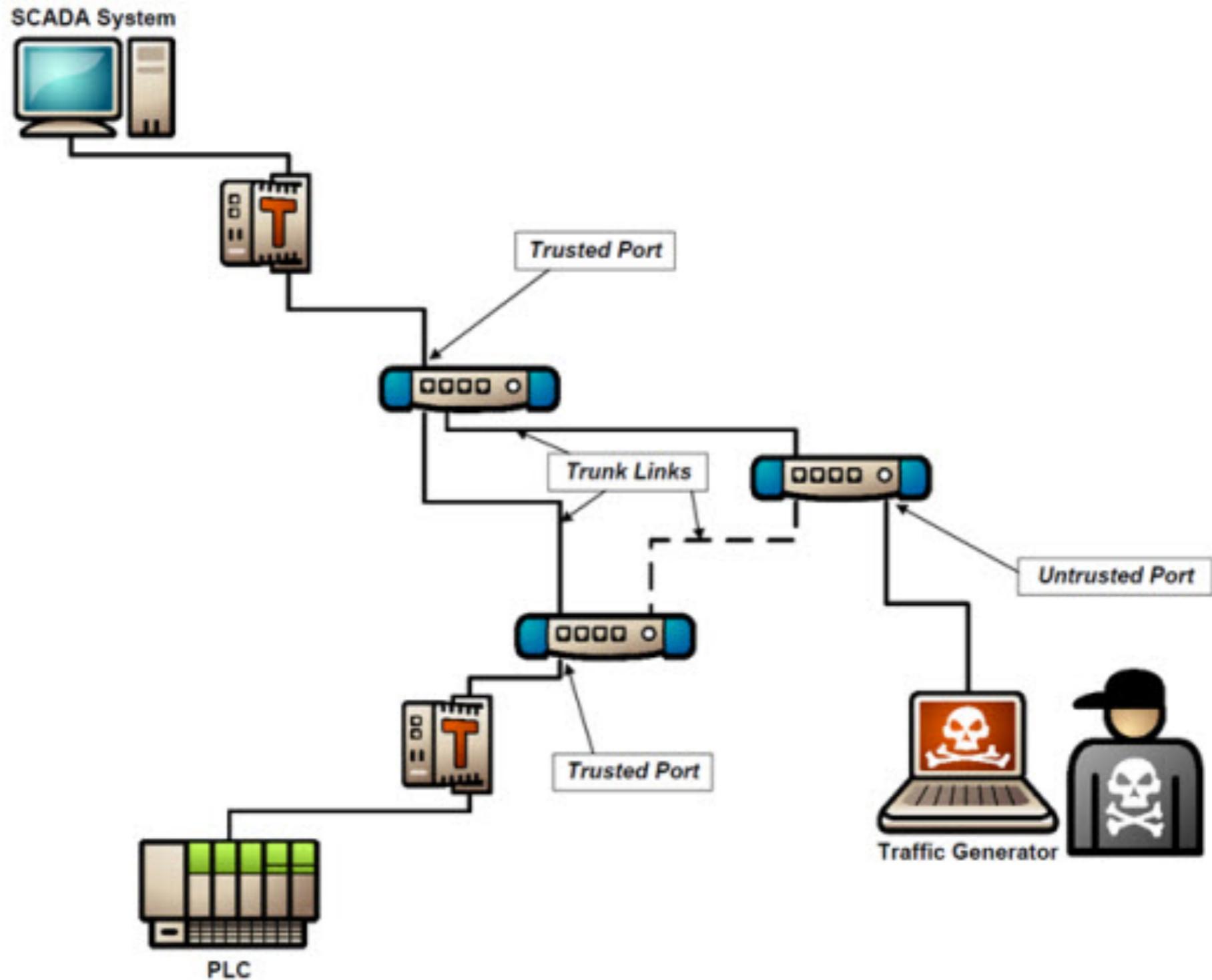
What to do?



What to do?



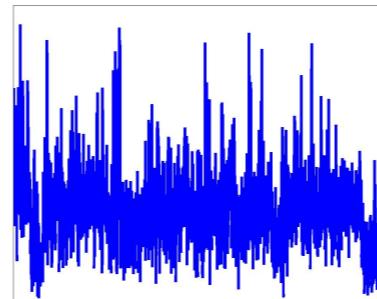
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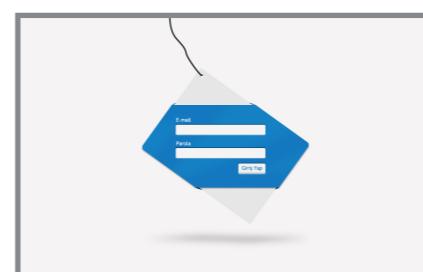
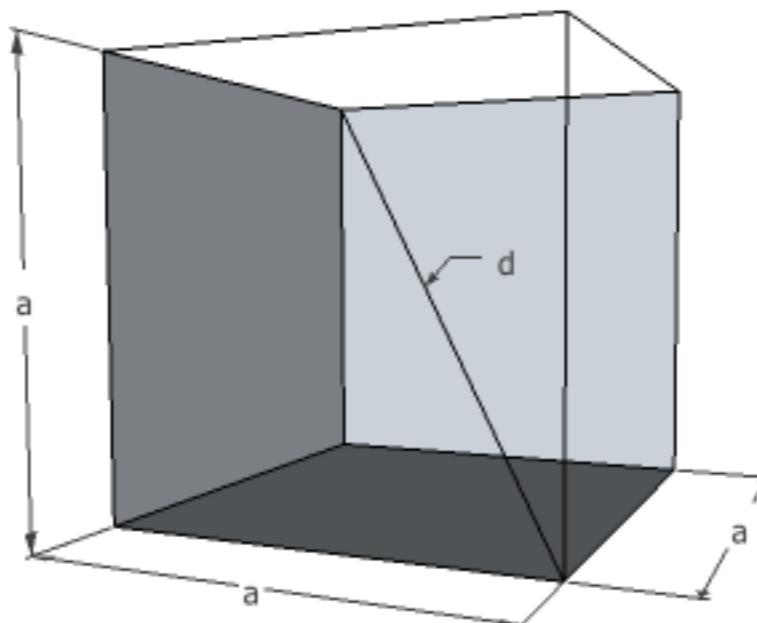
What to do?



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

Main OWASP Internet of Things Top 10 for 2014 Projects



OWASP
Open Web Application
Security Project

The OWASP Internet of Things Top 10 (tentative) - 2014 is as

- I1 Insecure Web Interface
- I2 Insufficient Authentication/Authorization
- I3 Insecure Network Services
- I4 Lack of Transport Encryption
- I5 Privacy Concerns
- I6 Insecure Cloud Interface
- I7 Insecure Mobile Interface
- I8 Insufficient Security Configurability
- I9 Insecure Software/Firmware Updates
- I10 Poor Physical Security

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



The screenshot shows a web page titled "OWASP Internet of Things Top 10 for 2014". The page features the OWASP logo (a purple circle with a white dragonfly) and the text "OWASP Open Web Application Security Project". Below the header, there is a list of ten vulnerabilities, each preceded by a blue circular icon containing a number from 1 to 10.

The OWASP Internet of Things Top 10 (tentative) - 2014 is as follows:

- I1 Insecure Web Interface
- I2 Insufficient Authentication/Authorization
- I3 Insecure Network Services
- I4 Lack of Transport Encryption
- I5 Privacy Concerns
- I6 Insecure Cloud Interface
- I7 Insecure Mobile Interface
- I8 Insufficient Security Configurability
- I9 Insecure Software/Firmware Updates
- I10 Poor Physical Security

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

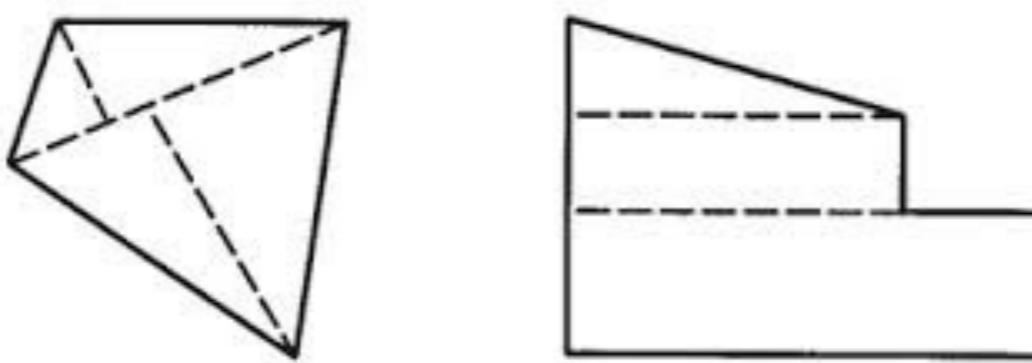


Different approaches

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
- ✓ Decommissioning system
- ✓ Lost access procedures

Device Memory

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

Administrative
Interface

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

Local Data Storage

Local Data Storage

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

Cloud Web Interface

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
Mechanism

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

Mobile Application

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

Ecosystem
Communication

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

Network Traffic

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

Page Discussion

Read View source View history

Search



OWASP IoT Attack Surface Areas

Main

OWASP IoT Attack Surface Areas

Project Details

[edit]



NETWORK TRAFFIC

Surfaces -> vulns -> data

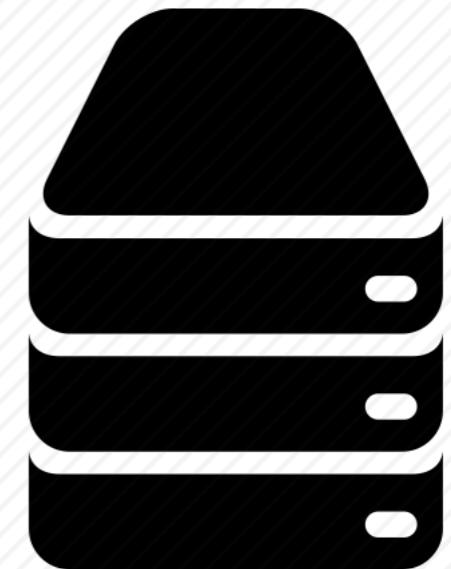
Attack Surface	Vulnerability	Data Type
• Administrative interface	• Weak password policy • Lack of account lockout	• Credentials
• Local data storage	• Data stored without encryption	• PII
• Web Cloud Interface	• SQLi	• PII • Account data
• Device Firmware	• Sent over HTTP • Hardcoded passwords • Hardcoded 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...

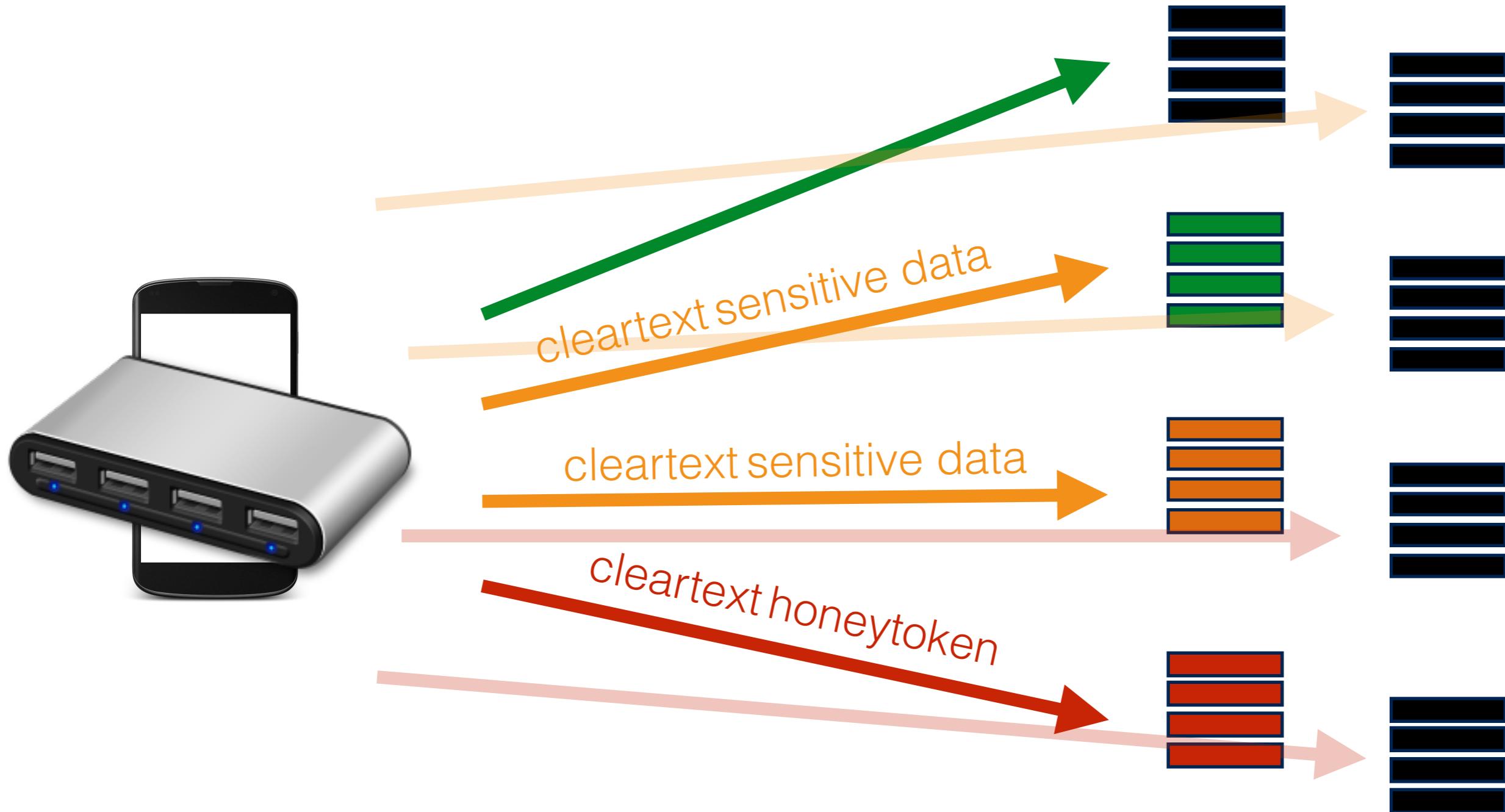
Network Traffic

- ✓ LAN
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- ✓ 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](#)

3 commits

1 branch

0 releases

1 contributor



Branch: **master** ▾

[caparser](#) / +



Added main code.



danielmiessler authored 3 days ago

latest commit `2f606c63d2`

[README.md](#)

Updated readme.

3 days ago

[caparser.sh](#)

Added main code.

3 days ago

[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

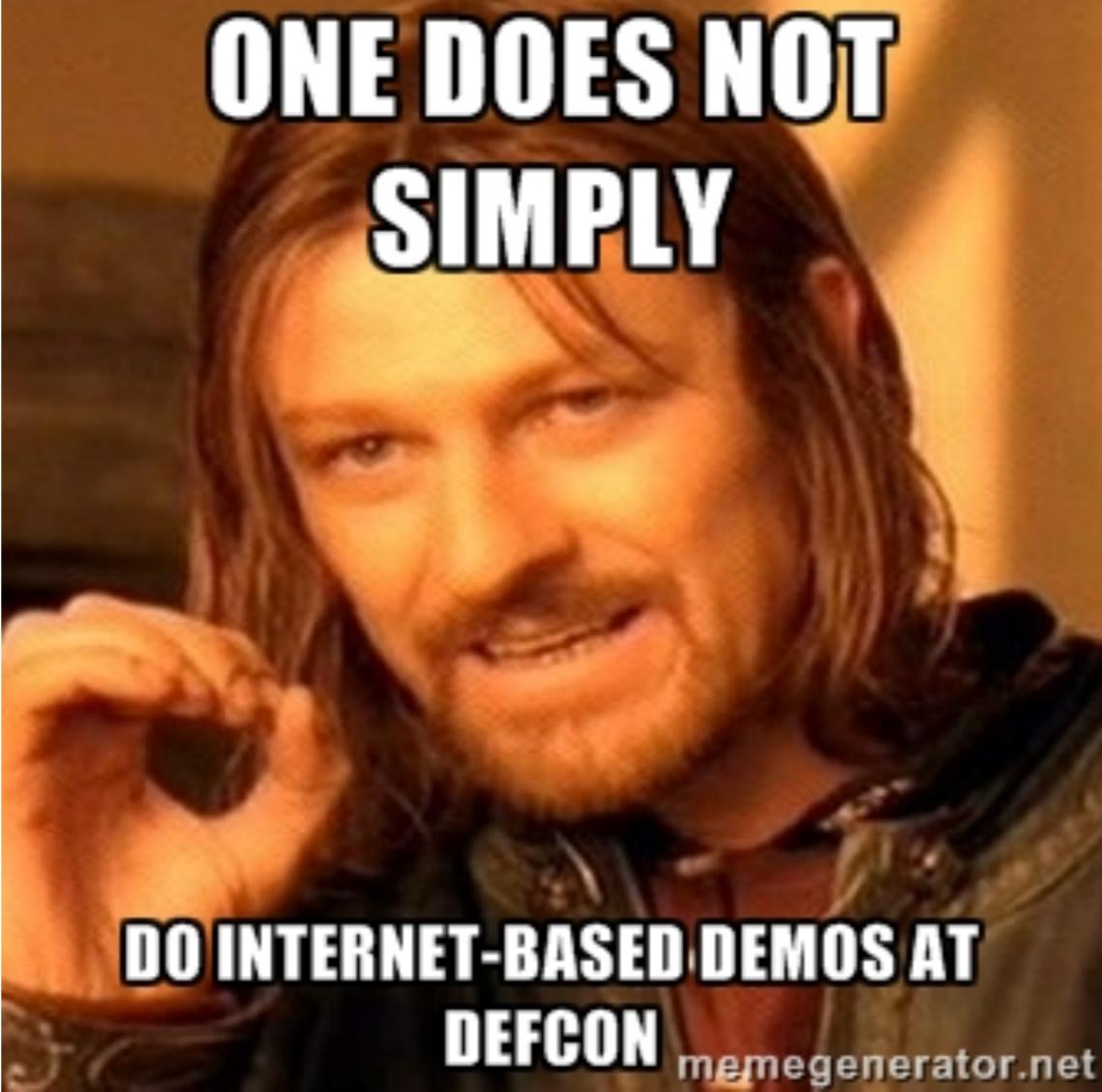
| [5 answered questions](#)

Price: **\$179.95**  | FREE One-Day

Only 13 left in stock.

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- 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••)
\$ █

The OWASP IoT Attack Surfaces Project

Ecosystem
Access Control
Device Physical
Interfaces

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

Device Web Interface

Page Discussion

Device Firmware

Read View source View history Search

Device Network Services

Administrative Interface

Local Data Storage

CLOUD WEB INTERFACE [edit]

Main OWASP IoT Attack Surface Areas Project Details

OWASP Open Web Application Security Project

MECHANISM APPLICATION APIs

ECOSYSTEM COMMUNITY UPDATE VENDOR BACKEND MOBILE VENDOR BACKEND THIRD-PARTY BACKEND APIs

NETWORK TRAFFIC



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Sister projects

I Am The Cavalry



BUILDITSECURE.LY

This is a Craig Smith Slide

Craig Smith

Takeaways and Goodies

1. IoT testing is the same as any other testing

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- 2. IoT security is NOT device security**

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7. Craig Smith is awesome
- 8. There's a handout!**

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 it uses signed files and then validates 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

Thank you!

ECOSYSTEM
ACCESS CONTROL

DEVICE MEMORY

DEVICE PHYSICAL
INTERFACES

DEVICE WEB
INTERFACE

DEVICE FIRMWARE

DEVICE NETWORK
SERVICES

ADMINISTRATIVE
INTERFACE

Caparser

CLOUD WEB
INTERFACE

ECOSYSTEM
COMMUNICATION

VENDOR BACKEND
APIS

THIRD-PARTY
BACKEND APIs

UPDATE
MECHANISM

@danielmiessler

VENDOR BACKEND
APIs

@craigz28

MOBILE

TX to HP Fortify on Demand

NETWORK TRAFFIC