ITS World Congress

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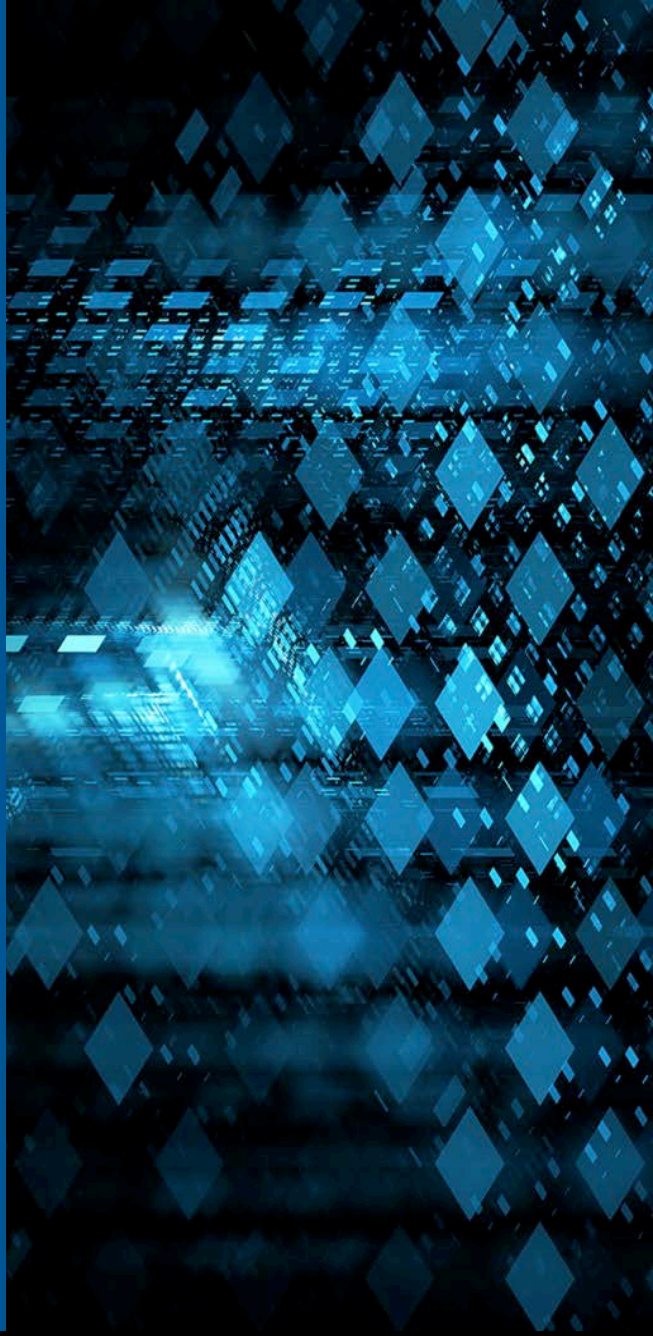

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Who am I?

- Vulnerability Researcher at Carnegie Mellon University
- Part of the CERT Coordination Center / Attack Modeling Team

- I research threats and vulnerabilities in connected vehicles, ITS platforms, robotics, and embedded systems.
- As part of the SEI Tactical Technologies Group, I prototype secure systems for disconnected environments.
  - Military, disaster response, harsh environments (e.g. Antarctica)

Qualifying risk in CAVs

- Total motor vehicle thefts in US, per year: **~700,000**
- Theft of goods from cars, per year: **$1.255B in 1.85M thefts**

- Proven criminal hacks* of cars, to date: **0**

- Most common “car hacking” tool:

* Not including key fob spoofing

Great! Let's go home.

Why would anyone bother to hack cars instead of stealing them / their contents the old fashioned way?

- Scale
  - Jeep hack: ~471,000 vehicles
  - Fleet mgmt devices: Hundreds of thousands
- Distance
  - For some classes of attack, can be done over the Internet
- No damage and/or evidence*
- New classes of crimes
  - Ransomware
  - "Autonomous kidnapping"
  - Remote control VBIED

No damage and/or evidence?

- How would you know if software or data is corrupted / altered?
- We need “black boxes” in cars
- Please log everything
  - Write-once
  - Encryption / Non-repudiation
  - Timestamp

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Potential Attacks / Impact

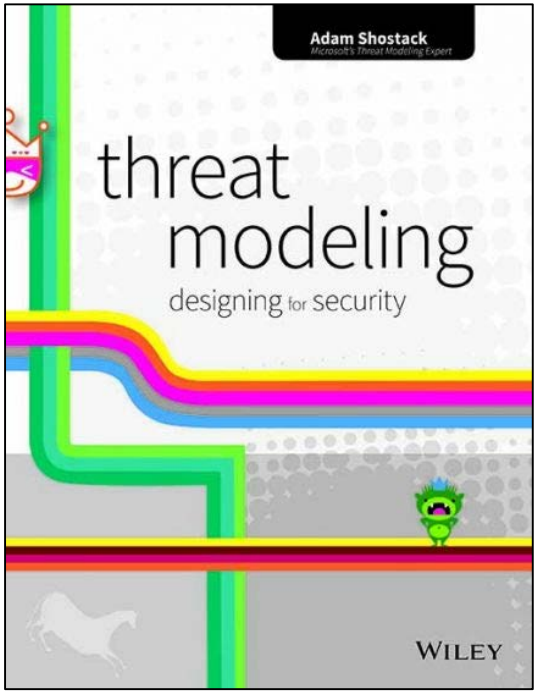
- Remote unlock / theft of contents
- Start car / theft of car
- Control car / cause accidents, panic, traffic jams
- Tracking vehicle's whereabouts
- Fingerprinting vehicle via RF signatures
- Espionage / eavesdropping via microphones or cameras
- Theft of information (e.g., contacts stored on car's IVI)
- Compromise other mobile devices
- Use mobile device to create Internet accessible back door

Threat modeling

We’re big fans of threat at modeling at CERT.

Shostack’s three types of threat modeling

- Software-centric
- Attacker-centric
- Asset-centric



Software-centric

Focuses on “risky” operations in software

(Microsoft)

STRIDE

S: Spoofing

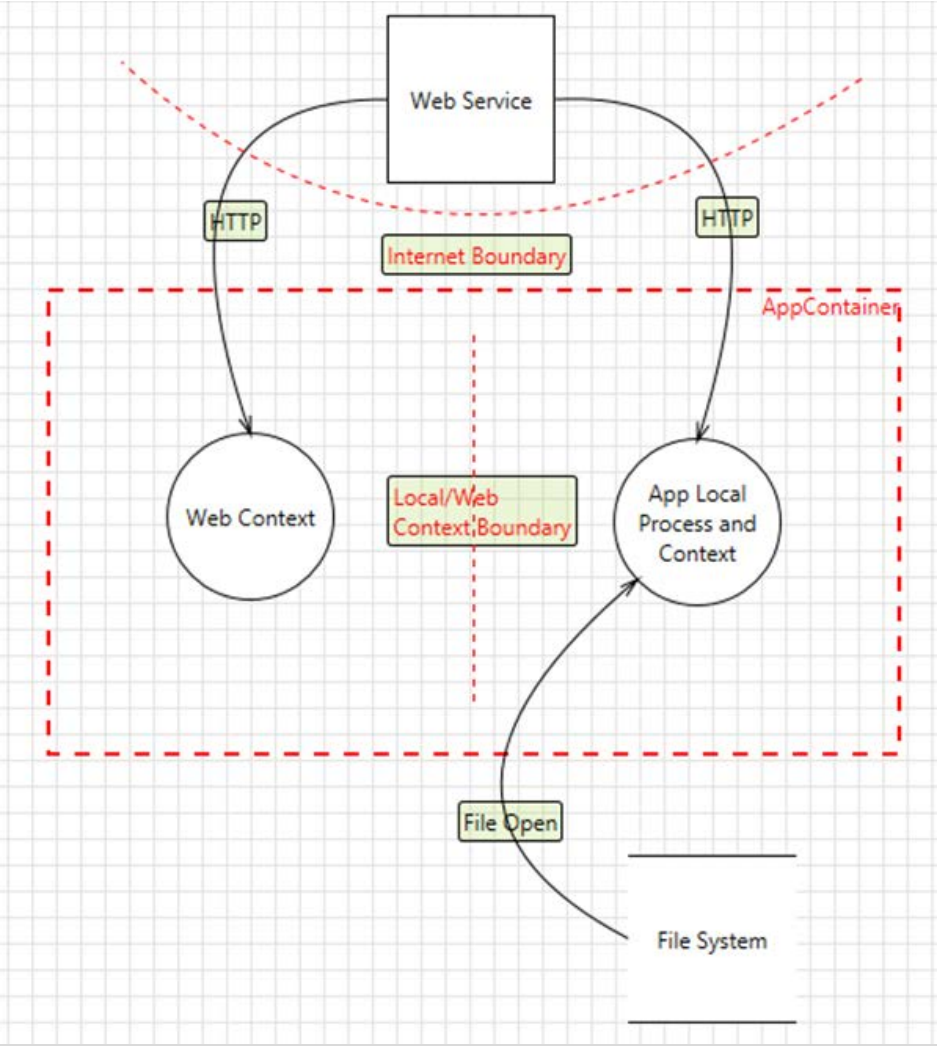
T: Tampering

R: Repudiation

I: Information Disclosure

D: Denial of Service

E: Escalation of Privilege



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Attacker-centric

(Sandia National Laboratory)

Table 1. Generic threat matrix

Threat Level	THREAT PROFILE						
	Commitment			Resources			
					Knowledge		
	Intensity	Stealth	Time	Technical personnel	Cyber	Kinetic	Access
1	H	H	Years to decades	Hundreds	H	H	H
2	H	H	Years to decades	Tens of tens	M	H	M
3	H	H	Months to years	Tens of tens	H	M	M
4	M	H	Weeks to months	Tens	H	M	M
5	H	M	Weeks to months	Tens	M	M	M
6	M	M	Weeks to months	Ones	M	M	L
7	M	M	Months to years	Tens	L	L	L
8	L	L	Days to weeks	Ones	L	L	L

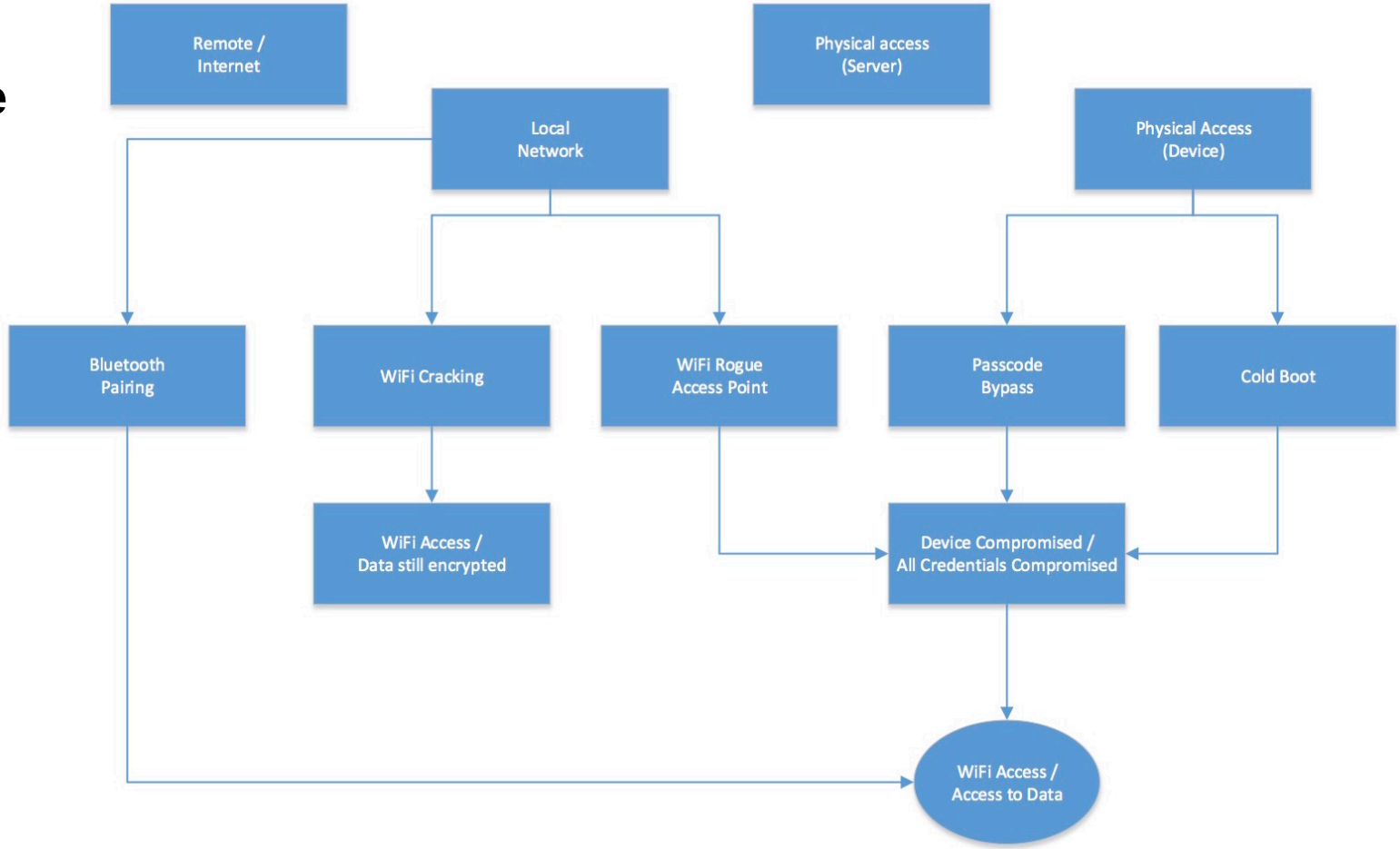
Reproduced from Duggan et al. [8].

Asset-centric

How would an attacker reach an asset?

Attack Tree

(Schneier)



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