Computer Security and the Internet of Things

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The Internet of Things

IoT: Any consumer device with computation and connectivity
Many Benefits

- Cars
- Toys
- Baby Monitors
- Light Switches
- Door Locks
- Furnaces
- Refrigerators
- Thermostats

IoT: Any consumer device with computation and connectivity
Many Benefits, But Also Risks

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This Talk: Security and Privacy Risks with IoT
IoT Security and Privacy Risks: A Broad Set of Issues

- Safety
- Privacy
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- Safety
- Privacy
- Inferred information
- Financial risks
- Stepping stones
- Zombies
- Uncertain future
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This Talk: Examples

Goal: Encourage broad thinking about security and privacy risks (and possible defenses)

Thank You: UW students, UW faculty, other students, other faculty, NSF, Google, Intel, Microsoft
Example 1: Modern Cars

- Engine
- Brakes
- Dash
- Steering
- Wheel speed sensor
- Telematics
- Satellite radio
- Remote door unlock / lock
- Diagnostics port

Example automotive computer network

What About Security?

Engine
Brakes
Dash
Steering
Wheel speed sensor
Telematics
Satellite radio
Remote door unlock / lock
Diagnostics port

Example automotive computer network

Approach

Bought two, 2009-edition modern sedans

– UW team bought one, kept in Seattle
– UC San Diego team bought one, kept in San Diego

Work published in 2010 and 2011

(Recently, new works published by others)

Multiple Entry Points

- Telematics
- Satellite radio
- Remote door unlock / lock
- Diagnostics port
- Wheel speed sensor
- Steering
- Dash
- Brakes
- Engine
- Example automotive computer network

Telephone Network

Internet

Telematics Service Provider

Attacker’s Internet Servers

Attacker

555-555-5555

Example automotive computer network

Attacker’s Internet Servers
Road Test: Apply Brakes

Road Test: Disengaging Brakes

Lesson: Safety Risks

End-to-end Theft Example

Call car, exploit vulnerabilities to implant new software, car connects (over Internet) to UW server, then run theft program

Lesson: Financial Risks
End-to-end Surveillance Example

Lesson: Privacy Risks

Call car, exploit vulnerabilities to implant new software, car connects (over Internet) to UW server, initiate surveillance
Example 2: Children’s Toys

Example 2: Children’s Toys

WiFi + webcam children’s toys are a thing

Unfortunately, webcams accessible to external adversaries

Lesson: Privacy Risks

Lesson: Financial Risks

Lesson: Who Admins

Lesson: Who Affected

Example 3: More On Cars

Example automotive computer network

Example 3: More On Cars

Lesson: Inferable Information

Example 4: Powerline Monitoring

Powerline monitoring enables per-device energy consumption visibility

Lesson: Inferable Information

Example 5: Home Automation

Example 5: Home Automation

Well known: If can compromise home automation controller, can affect devices in home

But what about non-networked devices?

**Lesson:** Stepping Stones

**Lesson:** Non-IoT IoT Devices

**Lesson:** Zombies

**Lesson:** Uncertain Future

Thanks!

Automotive computer security (UW, UC San Diego)
   – Karl Koscher, Alexei Czeskis, Franziska Roesner, Shwetak Patel, Stephen Checkoway, Damon McCoy, Brian Kantor, Danny Anderson, Hovav Shacham, Stefan Savage

Toy computer security (UW)
   – Tamara Denning, Cynthia Matuszek, Karl Koscher, Joshua R. Smith

Automotive driver fingerprinting (UW)
   – Miro Enev, Alex Takakuwa, Karl Koscher

Powerline monitoring (UW)
   – Miro Enev, Sidhant Gupta, Shwetak Patel

Home automation security (UW)
   – Temitope Oluwafemi, Sidhant Gupta, Shwetak Patel
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