Remote Vehicle Interaction
February 23, 2017 | Securing the Connected Car

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Connected cars may be vulnerable
Everyone's talking about car hacking...
Chrysler recalls 1.4M cars after Jeep exploit

- Miller & Valasek discovered exploit via cellular network
- Remote control of critical systems, including brakes
- One scan found over 2,500 vehicles

Photo credit: Andy Greenberg, Wired
Tesla hit by malicious wifi exploits in 2016

- Sep: Keen Security Lab announces remote exploit via in-car browser
- Nov: Promon AS announces remote exploit via Android app

Photo credit: Darrell Etherington, TechCrunch
Automotive software architecture is complex
Add external sources…

… and it just gets more complex

Photo credit:
GENIVI is standardizing how cars connect securely to remote devices
RVI is middleware for service-oriented arch
RVI Architecture Overview

API based
The API is the driving technology. Implementation is secondary.

Data Router commonality
Data Router connects all services on all devices.

Mix of open and closed source
Components can be off the shelf, OSS, proprietary, or a combination of the above.

Network complexity shielding
A clean transaction API alleviates services and applications from connectivity concerns.
RVI has been implemented in several ways

• Proof of Concept implementations exist for:
  – Erlang: cross-platform executable and message bus
  – Objective-C: iOS SDK
  – Java: Android SDK
  – C: cross-platform library

• All implementations are available on GitHub:
  – https://www.github.com/GENIVI?q=rvi
Why RVI?

• Completely open source
• MPL 2.0 licensing supports commercial integration
• Reference implementations exist for Software, Firmware Over The Air (SOTA/FOTA) and Big Data
• Demos for HVAC, and Mobile Unlock
How does an app developer work with RVI?

1. **Mobile Application Sends Command**
   HVAC App sends a message, targeting a given service URI, to Service Edge.

2. **Locate Target Node**
   Service Edge asks local service Service Discovery to resolve service name to a network address.

3. **Return Network Address**
   Specifies where the target service can be reached.

4. **Send Request to Vehicle**
   The vehicle data router processes the command.

5. **Forward Request to HVAC Service**
   The HVAC Service in the vehicle executes the command.
What security features are present in RVI?

• Require TLS/DTLS v1.2 or higher to secure connections
• Asymmetric cryptography with Public Key Infrastructure
• Access controls are self-carried in JSON Web Tokens signed by Root of Trust to safeguard against tampering
• Access control checked before sending and upon receipt
Authorization - overview

1. Create, sign credential (JSON Web Token)
   A JWT granting access to the mobile device is created and signed with provisioning server's private key.

2. Distribute credential to mobile device
   The targeted device receives its certificate

3. Mobile sends request, credential to Vehicle
   The credential states that mobile device has the right to execute the given request

4. Validate credentials
   The JWT and request is validated by the vehicle using the public key of the trusted provisioning server

5. Execute request
   The validated command is forwarded to the target service for execution
What’s next for RVI?

• Work to extend & mature proof of concepts continues
• GENIVI project to field test RVI in smart city pilot
• Big Data demos and IoT integration
• Visit GitHub repos to give it a try – no car required!
Links

• C Proof of Concept: https://github.com/GENIVI/rvi_lib

• Erlang POC: https://github.com/GENIVI/rvi_core

• Mobile: https://github.com/PDXostc/rvi_core_android
  https://github.com/PDXostc/rvi_core_ios

GENIVI Projects: http://projects.genivi.org/
Further Reading on Automotive Security

• Craig Smith, “The Car Hacker’s Handbook”
  http://opengarages.org/handbook/


• Lee Pike, et al, “Securing the Automobile: A Comprehensive Approach”

• Got a recommendation? Email me: tjamison@jaguarlandrover.com
Thank you!

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