Monthly Research 2016.08

Black Hat USA 2016 Survey Report

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About Black Hat USA

- The world's largest security conference in Las Vegas at every August
  - Briefings of cutting-edge security research
    - Threat demo, exploit technique, defense technology
    - They have breakthrough or advantage
    - Slides and papers are public on the Web
  - Yuji Ukai, CEO of FFRI, Inc. is a member of the review boards
  - There was published many tools and projects
    - Apple launches bug bounty project the Apple Security Bounty

- Many security events (DEFCON, BSideLV, USENIX) were held near term

- In This Slide, we introduce hot research in Black Hat USA 2016

Hot Research (1)

- Vehicle
  - CANSPY: A Platform For Auditing CAN Devices
    - Jonathan-Christofer Demay & Arnaud Lebrun
  - Advanced CAN Injection Techniques For Vehicle Networks
    - Charlie Miller & Chris Valasek
  - Can You Trust Autonomous Vehicles: Contactless Attacks against Sensors of Self-driving Vehicle (DEFCON 24)
    - Jianhao Liu, Chen Yan, Wenyuan Xu

Hot Research (2)

- IoT
  - Into The Core – In-Depth Exploration of Windows 10 IoT Core
    - Paul Sabanal
  - GATTacking Bluetooth Smart Devices Introducing a New BLE Proxy Tool
    - Slawomir Jasek
  - GreatFET: Making GoodFET Great Again
    - Michael Ossmann

CANSPY: A Platform For Auditing CAN Devices (1)

- Capture tool for the CAN bus
  - Circuit board data and software are open source
    - https://bitbucket.org/jcdemay/canspy
- Connect to OBD-II
  - It intercepts like server-client MITM attack
    - Intercept in-between bus for ECU-ECU
- Analyze of captured frame
  - CAN protocol stack is SocketCAN
  - SocketCAN is supported by the Wireshark
    - We are able to analyze captured frame by writing a dissector

CANSPY: A Platform For Auditing CAN Devices (2)

- PC-ECU connection(CAN over Ethernet)
  - Sniffing and bridging CAN bus from PC
    - Inject CAN message using bridge service
    - Rewrite frame and packet using Scapy

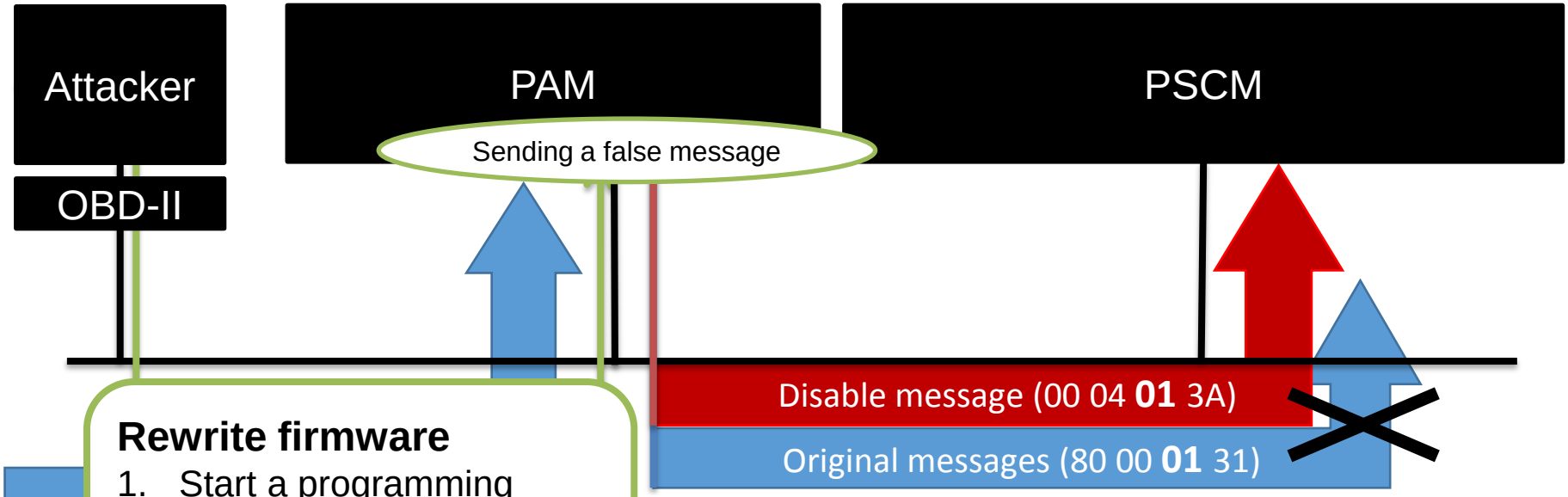
- **Comments of FFRI researcher**
  - CANSPY is high-quality analysis tool
  - Point of improvement
    - The internal filtering capabilities
  - This tool is useful for analysis for non real time function
    - E.g.) Fault diagnosing function and device

Advanced CAN Injection Techniques For Vehicle Networks (1)

- Continued research called "Jeep Hack" by Charlie Miller and Chris Valasek
  - That is drawing any attention and extensively quoted in the media
- Researchers were getting a "Pwnie for Best Junk or Stunt Hack" on The Pwnie Awards for 2016
- They were able to control steering even when the car is driving at high speed
- Brake, accelerator and steering were bypassed restriction at the Parking Assist Module(PAM) and the Adaptive Cruise Control
  - They disguised packet for speed camouflaging
    - PAM haven't gotten speed from the legitimate ECU
- Rewrite firmware on the Power Steering Control Module (PSCM) ECU
  - PSCM firmware has a 16bit checksum
  - It is bypassed in less than 9 hours
- Message injection and confliction
  - PAM disables message and restart ECU at message confliction
  - E.g.)The car is stopped > Attacker suddenly injected "100 mph“ > Confliction

Advanced CAN Injection Techniques For Vehicle Networks (2)

Rewriting firmware and measuring message conflict



Rewrite firmware

1. Start a programming diagnostic session
2. Get security access
3. Write new firmware

Message confliction

- The third byte is counter
- It's checking at message duplicate
- Third byte is faking
- Injecting just before at true message
- Original messages were ignored

Advanced CAN Injection Techniques For Vehicle Networks (3)

- Jeep and Prius are different correspondence to the unreliable sudden braking messages
  - Jeep: Cancel messages and restart ECU
  - Prius: Non check, activate the brakes
    - Toyota seems to give priority to safety

- CAN injection countermeasures
  - Automobile manufacturers fix the danger algorithm
  - Monitoring of CAN message frequency

- **Comments of FFRI researcher**
  - Vehicle has many system, so it is necessary to take measures and threat analysis of the various points of view
  - Research related to "arrival frequency of message" is already exist

Can You Trust Autonomous Vehicles: Contactless Attacks against Sensors of Self-driving Vehicle (1)

- This research was published DEF CON 24
- Presented by Chinese university and the Qihoo360 researchers
- Attack various sensors in vehicle
  - This attack has been verified in the actual vehicle sensors
    - The Tesla, The Audi and others
  - Similar research was published the Black Hat EU 2015
- Vehicle sensors are important for ADAS
  - E.g.) Ultrasonic sensors, Millimeter Wave Radars
- Attacking methods
  - Jamming
    - Common frequency intense noise to denial of service
  - Spoofing
    - Signal which was disguised as a valid signal
  - Relay
    - Relay received signal

Can You Trust Autonomous Vehicles: Contactless Attacks against Sensors of Self-driving Vehicle (2)

- Attacking Ultrasonic Sensors
  - This sensor measures the distance to obstacle
  - Researchers experimented two types of attack
    - Jamming
      - Irradiate the ultrasonic wave to the sensor
      - The sensor can't receive reflected wave
      - Therefore, Sensor doesn't recognize the obstacle
    - Spoofing
      - Irradiate ultrasonic waves of equivalent the output and waveform to the sensor
      - The sensor was misidentified the obstacle distance
  - Experiment equipment was made with the Arduino and ultrasonic transducer
  - This attack can provoke crash deliberately

Can You Trust Autonomous Vehicles: Contactless Attacks against Sensors of Self-driving Vehicle (3)

- Attacking Millimeter Wave Radar
  - This sensor measures distance to the obstacle of front
  - For Front collision avoidance and traffic-aware cruise control
  - Researchers experimented two types of attack
    - Jamming (76 - 77 GHz)
      - Obstacle couldn't detect
    - Spoofing
      - The Sensor was mistaking the distance between the obstacle and car

- **Comments of FFRI researcher**
  - The result has big impact, because it verified at the actual vehicle
  - Equipment for attacking the ultrasonic sensors is not expensive
  - We feel the possibility of actually attack

Into The Core – In-Depth Exploration of Windows 10 IoT Core (1)

- Research of Windows 10 IoT Core
- The security features
  - Windows Defender is unsupported
  - Microsoft Passport is unsupported
    - Two-factor authentication by Windows Hello (biometric) or PIN
  - Secure boot
    - If the boot target hadn't attestation, the system wouldn't boot
      - It’s protected system from rootkit and bootkit
  - BitLocker
    - Encryption of user and system files
  - Windows Update is forced, but the Pro edition can postponement

Into The Core – In-Depth Exploration of Windows 10 IoT Core (2)

- Network services and drivers
  - It has many wireless driver (Wi-Fi, Bluetooth, ZigBee, Z-Wave)
    - If the driver was attacked, system privilege will be hijacked
  - UDP multicast
    - Windows IoT devices are informing oneself by using the UDP multicast
    - Anyone can check the device name, IP address and others in the packet
- Debugging with PC
  - IoT device (Raspberry Pi 3), USB-UART adapter(Shikra)
  - Activates serial debug on the device by using SSH or PowerShell
  - Debugging kernel using WinDbg at the COM port
  - Other approaches, debugging user mode process, analyzing crash dump

Into The Core – In-Depth Exploration of Windows 10 IoT Core (3)

- How to mitigate security risk of the Windows 10 IoT device
  - Network segmentation
    - You should separate PC and server from IoT devices
    - Measures against the infection from the internal network
  - Using firewall to protect network services
  - Using hardware which support the TPM
    - E.g.) Minnowboard + Dragonboard, Raspberry Pi + Discrete TPM
  - Using BitLocker and Secure boot
- Conclusion
  - Device maker should be careful about security setting
- **Comments of FFRI researcher**
  - We also pointed out that the security of Win10 IoT Core in the past
  - This research has novelty as proposing various hardware and research technique

GATTAttacking Bluetooth Smart Devices – Introducing A New BLE Proxy Tool (1)

- Gattacker is a proxy tool for BLE
- This tool can attack the device of Unencrypted communication
  - It is possible to attack the device of unencrypted communication by MITM
- For example
  - Sniffing and DoS for BLE smartLock
    - Attacker can unlock smartlock house or car at any time by sniffed data
    - Attacker, also it is possible to interfere with the locking by inhibiting the valid operation
  - Attacker can intrude payment process on BLE

- MITM flow
  - GATTacker will monopolize advertising packet of BLE device
  - GATTacker also sends advertising packet
  - GATTacker receives an application request
  - GATTacker bridges the device without being noticed
  - As a result of the above, allows sniffing and modification of communication

GATTAttacking Bluetooth Smart Devices – Introducing A New BLE Proxy Tool (2)

- Countermeasure to attacks on exposed services(E.g. payment)
  - Provider is setting the deadline for expose the services

- Countermeasure to attacks on pairing
  - Encryption of BLE
  - Random MAC Address
  - Whitelist of MAC addresses

- **Comments of FFRI researcher**
  - You should combine whitelist filtering and other countermeasure because MAC address can camouflaged

GreatFET: Making GoodFET Great Again (1)

- GeatFET is improved version of the GoodFET
- GoodFET is an open-source JTAG adapter
  - More than twenty variants of the GoodFET hardware platform were developed
    - http://goodfet.sourceforge.net/

- Issue of GoodFET
  - Software is complex and difficult to maintain
  - Higher speed peripherals not available
    - Interfaces such as SPI are implemented by bit-banging

GreatFET: Making GoodFET Great Again (2)

- GreatFET Advantages
  - This tool is using LPC4330 of higher performance microcontroller with USB interface
  - LPC4330 can use the USB boot loader at just push one button
  - It supports the tractable expansion interface at called a "neighbor“
- GreatFET demerits
  - GreatFET takes longer to hand-assemble than GoodFET because parts are increased
- **Comments of FFRI researcher**
  - This tool is good is that the high-performance peripheral device can be used
  - The cost take more than GoodFET
  - It is recommended if you require higher performance
  - Hand-assemble takes the technique of electronic work

Conclusions

- Cyberattack for Vehicle and IoT got to more realistic
  - The vehicle was hijacked from remote during high-speed driving
  - Tool was released for BLE MITM Attack more easily
    - BLE is one of the most important protocol for IoT
- Research of defense technology is also making progress
  - Each country is doing research for defense based on the previous research
  - Each industry are conducted the bug bounty program for getting the advantage against the attacker side
- The Black Hat USA was excellent again this year
  - There are many other interesting research are published

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