
OCEAN TOMO
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Software Analysis, Testing &
Reverse Engineering Capabilities

Technical Capabilities

- **Software Analysis, Testing and RE**
- Wireless Testing and RE
- Semi/Systems Testing and RE
- Digital Media/Video Testing and RE

Testing & Reverse Engineering Scope

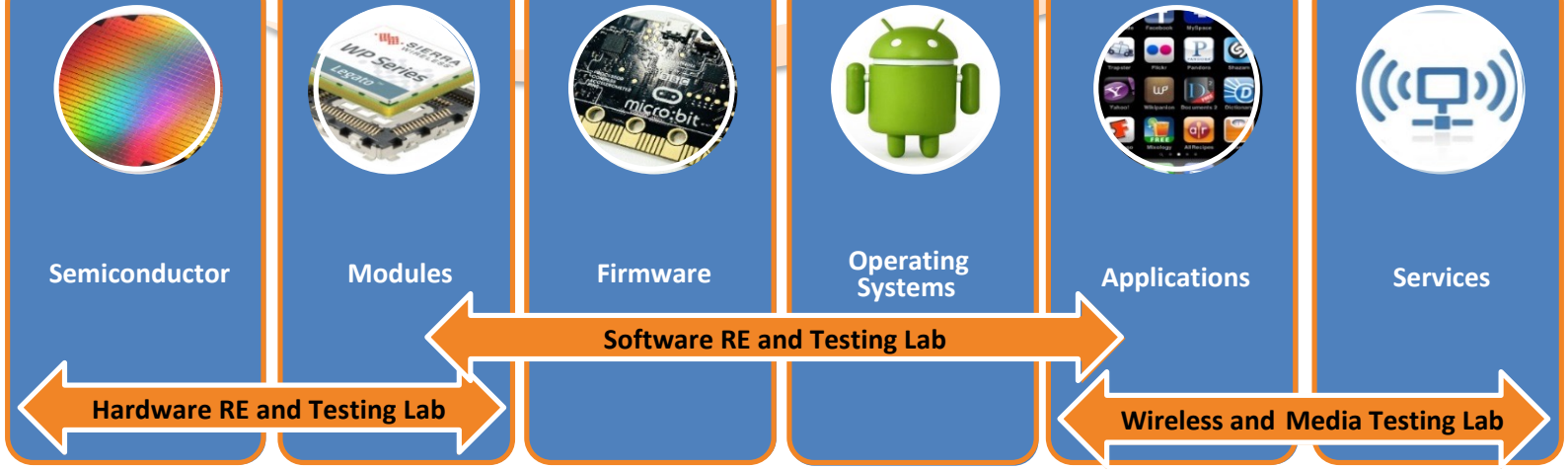
- Package RE
- Process RE
- Circuit RE

- Teardown
- Device identification
- Functional testing

- Code extraction
- Decompile
- Disassembly
- Algorithm analysis

- Mobile OS
- Embedded OS
- Cloud software
- System software

- Connectivity
- Mobility
- Security
- Location
- Media



Outline

- Software Expertise
- Software Reverse Engineering Process
- Examples of recent projects

Software Experts

Team of experts with development experience at all software levels and for various applications:

- Firmware/Embedded Systems
- Security & Encryption
- System-level software
- Application software
- Operating systems
- Cloud computing
- Source Code

Software Analysis, RE & Testing Experience

- Firmware Extraction and Analysis:
  - Connectivity: Ethernet, USB, WiFi
  - Memories: DDR, Flash
  - Audio and Video encoders
  - DSP engines
  - Processor cores
- System and App Software Analysis:
  - Range of programming languages from Assembly to Java, Python, etc…
  - Networking: variety of communications protocols
  - Databases: Oracle, Informix, DB2, SQL, MySql
  - User interfaces
  - Drivers: wired and wireless controllers, flash controllers

Software Analysis, RE & Testing Experience

- Operating systems internals and applications:
  - Range of operating systems: VxWorks, Linux, OSx, Android, Windows, etc…
- Security:
  - PKI, Fraud detection, Secure e-mails
  - Authentication Systems, Smart Card, Biometrics

Types of Analyses

- Static Analysis
  - Analysis without code execution (Effective in producing evidence)
  - Analysis of both source code and compiled code
  - Use of use cutting edge tools like Ghidra, IDA Pro, and BinaryNinja to analyze the binaries

- Dynamic Analysis
  - Analysis through code execution (Effective in showing actual code being implemented)
  - Monitor and “hook” the running code to more intricately understand the inner workings of the application under investigation
  - Use of a number of tools to gather run-time data

- Binary Dissection
  - Use of tools like Wireshark and Scapy to observe and model network communications
  - Tools for decrypting of communications between a device and a cloud
  - Bus monitoring tools and logic analyzers to observe digital communications between components

Approach at Accessing Firmware/Software and Analysis

- **Consider Accessibility of firmware/Software**
  - Is the source code available (e.g. Publicly available Android source code)
  - What are other techniques available to access the firmware
    - Extraction of Flash content via HW or SW mechanisms (e.g. Runtime mechanisms, Routing, etc…)
- **Extract the firmware content from Flash device using selected mechanism**
- **Prepare extracted firmware for analysis**
  - Bit flip, decryption, disassembly, de-compilation, etc…
- **Analysis of de-compiled firmware**

Recent Firmware Analysis Projects

- Set Top Box analysis
- Secure world (TrustZone) in cell phones, TVs, laptops, and tablets
- Garbage Collection of processes in cell phones, TVs, laptops, and tablets
- Embedded systems booting sequence analysis for network switch products
- User authentication module of a client – server secure application
- Qualcomm Hexagon DSP analysis
- Android phone firmware analysis for noise cancellation

Example Projects

- Example 1: Secure World (TrustZone) in TV
- Example 2: Garbage Collection of processes in TV
- Example 3: Analysis of baseband chip functionality on a smartphone through a combination of hardware and software/OS testing and data sheet analysis
- Example 4: Tracing a path of video data in a system which simultaneously stores and displays video data
- Example 5: Analysis of a DSP disassembly code to find links between functions of interest

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