Linux and Law Enforcement

Challenges and Opportunities

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whoami

- Dr. Joshua I. James
  - Full-time Linux user for past 6 years
  - Develop “foss” tools for digital investigators [http://cybercrimetech.com]
  - Lecturer/Researcher SCH, KU, KNPU
  - Consultant: UNODC, INTERPOL, KNPA
  - Have trained Police / Prosecutors / Judges from over 100 countries on Digital Crime & Investigation
  - Focus on the automation of digital investigation processes

Overview

- What is 'normal' cybercrime?
- Linux for Criminals
- Linux for Law Enforcement
- Linux and Legal Systems
- The Law Enforcement *community*
- GitHub's impact on Law Enforcement
- Linux Education for Law Enforcement
- More than just cyber**crime**
- Conclusions

General Cyber Crime

- Cyber crime often targets **mass markets**
  - # of attacks against systems correlate to market share
    - Desktop: MS Windows to target users, OSx gaining attention
    - Servers: Linux-based & MS Windows-based
    - Mobile: Linux-based, iOS
    - Other embedded: Linux-based

General Cyber Crime

- Attacks against Linux-based systems
  - (Servers / Embedded) Mostly configuration issues
  - Software: Not enough app security testing in the community
    - Pick a community app, and fuzz it
    - Security testing is not easy
  - Client-side: Social engineering works great!
    - Mobile-device app permissions, sometimes helpful
    - Android targeted by an estimated 97% of malware in 2013[1] (third-party app stores, apk downloads)

General Cyber Crime

- For the average user, they don't notice they are infected until...
  - Their system stops working
  - Their bank account looses money
  - Phone bill is much higher than expected
- For the average SMB, they don't notice they are infected until...
  - Another company / org tells them
  - Their customers tell them
- Most people are infected, and will never know as long as the malware does not affect their 1) money or 2) user experience (much)

General Cyber Crime

- “Normal” cybercrime is actually pretty boring
  - Low-tech
  - Basic Fraud / IP theft / Illegal Content
- Advanced cybercrime usually related to organized crime and / or Governments
- Most advanced cybercrime is not detected / reported
- Police will normally only look at crimes their citizens are interested in

General Cyber Crime

- Advanced attacks don't necessarily mean advanced techniques

NEWS

Snowden accused of using hacking's greatest weapon to access NSA files: wget

Exfiltrated data said to be using previously unknown port 80. Experts remain amused by media hype.

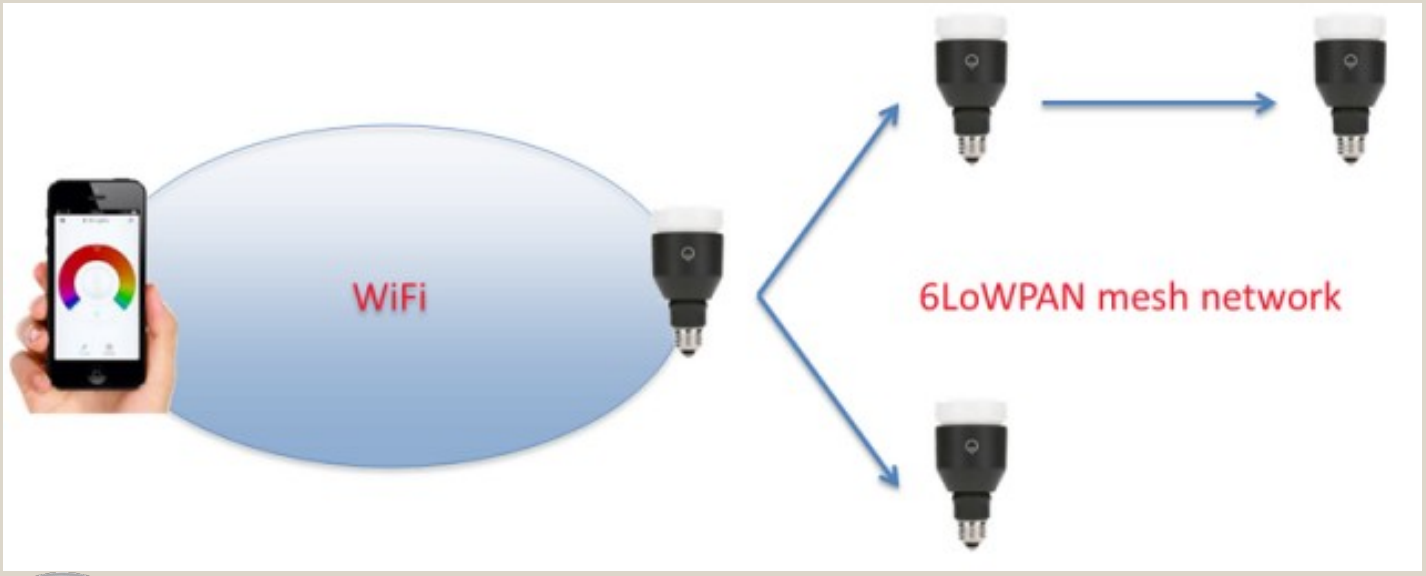
http://www.csoonline.com/article/2137013/network-security/snowden-accused-of-using-hacking-s-greatest-weapon-to-access-nsa-files--wget.html

Linux for Criminals

- Linux is perfect for criminals!
  - Extremely powerful
  - Completely customizable
  - Runs on almost anything
  - Excellent for automation
- Basic Linux understanding gives you all the tools you need to mess with systems / networks
- Network policies are normally applied to MS Windows systems – Linux lockdown is an afterthought (maybe)

Linux for Criminals

- Now everything is connected, and is used for illegal compute, information stealing, and just messing with people
- DDoS or full control of IoT networks so far is not difficult with basic sniffing ability (made easy in Linux): TV / Lights / Drones



http://arstechnica.com/security/2014/07/crypto-weakness-in-smart-led-lightbulbs-exposes-wi-fi-passwords/

Linux for Criminals

- Linux pre-configured for hacking (pen-testing)
  - Kali Linux [http://www.kali.org/]
  - It is awesome! / It is scary!
  - Anyone, even as a hobby, can easily learn basic security testing (and break stuff)
  - Netizens, hactivists and organized crime are learning
  - Governments and businesses are not

Linux for Criminals

- Criminals:
  - Have an interest in becoming *experts* at the technology
    - Linux / Unix / Windows / Phones / etc
  - Have incentive (money) to become experts
    - Individuals
    - Organized crime

Linux for Law Enforcement

- Law Enforcement:
  - Some have an interest in becoming *experts* in the technology
    - Expert level LE normally move to corporate
  - Many want minimum knowledge to do their job
  - Usually no extra incentive to learn new technologies
    - Many countries do not recognize / invest in cybercrime investigation
    - Many countries have corruption problems
    - Altruism only goes so far

Linux for Law Enforcement

- Law Enforcement:
  - Knowledge greatly depends on region, funding and level of country development
  - Incentives depend on Government
  - Investigation technology sometimes dictated by government or legislation
    - Always behind

Linux for Law Enforcement

- For cybercrime and digital forensics investigation, most countries are locked into MS Windows
  - Three most popular investigation toolkits are Windows-based
  - Most investigation tools are closed-source, commercial

Perception of Linux by LE / Gov.

- Law Enforcement in many countries believe commercial, MS Windows-based software is better for investigations
  - Point and click – easy to do a basic “investigation”
  - Easy to understand commercial software licensing and business models

Perception of Linux by LE / Gov.

- Practical:
  - Linux is HARD
    - What is this CLI stuff?
    - Too many commands – “so hard to remember!”
    - Piping?
    - “I am not a programmer!”
  - Not easy to get started
    - Communities can be very good and very bad

Perception of Linux by LE / Gov.

- Legal:
  - Evidence derived from Linux / Open Source tools *might* be accepted in court
    - Depends on the country
    - Depends on the confidence / competence of the investigators
  - Difficult to trust Linux
    - Who will stand up for Linux in court?
    - Belief that Linux is made by hackers in their mom's basement
  - Community models and licensing models are really, really confusing

Perception of Linux by LE / Gov.

- Legal (cont):
  - Some (few) countries actually ***prefer*** Open Source tools for investigations
  - **Italy**: gives priority to free and open source tools for investigations
  - Why? We can check the source to see exactly what the code is doing
  - Third-parties can verify the code is working as expected

For an interesting discussion, please see: http://www.digital-evidence.org/papers/opensrc_legal.pdf

Linux for Law Enforcement

- Investigators using Linux:
  - Tend to develop their own tools / systems
  - Automate more of their work
  - Are very active in investigation and learning
  - Have support from management
- Expert investigators choose whatever tool works best, regardless of platform (for some tasks commercial, closed-source is necessary)

Linux for Law Enforcement

- Cybercrime Investigation
  - Usually involves understanding network traffic and routing
  - Linux systems have a lot of tools available for network analysis
  - Systems can easily be employed to collect network traffic (good or bad)
  - Many of the VPN/Proxy/Tor/Web servers from which LE get their logs are Linux/Unix-based

Linux for Law Enforcement

- Digital Forensic Investigation
  - Normally involves text / data analysis
  - Must be able to analyze many different data structures
  - Need to sort massive amounts of data for each case
  - Linux has free, built-in tools that are better for some types of digital forensic analysis than expensive commercial tools
  - Experimental digital investigation tools are normally developed on (or compatible with) Linux systems
    - Scripting languages (Perl/Python) very popular with LE

Law Enforcement Community

- Quite closed
  - Difficult to share information
  - Difficult to share data
  - Many tools and courses developed “for Law Enforcement only”
- Many LE believe that criminals don't know their techniques
  - Criminals are way ahead

Law Enforcement Community

- Open Source Law Enforcement community is gaining popularity
- Many open source / FOSS projects are being created for digital investigation purposes
- Part of the popularity comes from the “Open Source Digital Forensics Conference” (OSDFcon) held by Basis Technology (USA)[2]
- Increased interest is also coming from
  - Open Source Hardware projects
  - Easier consumer-level customization
  - Better online instructions

Open Source Tools

- A number of the most popular Linux-based open source tools include:
  - The Sleuth Kit http://www.sleuthkit.org/
  - Guymager http://guymager.sourceforge.net/
  - Digital Forensics Framework http://www.digital-forensic.org/
- Live CD distributions:
  - DEFT http://www.deftlinux.net/
  - CAINE http://www.caine-live.net/
  - KALI http://www.kali.org/
- Many “investigation automation programs” are built on top these systems
- Linux can already handle a lot of investigation tasks 'out-of-the-box'
- Again, many popular tools are cross-platform
  - Investigators need to support data collection and analysis on every kind of device

Open Source [Hardware] Tools

- As hardware components become less expensive, investigators can begin to build custom devices for investigation
- FIREBrick http://digitalFIRE.ucd.ie
  - Hardware write blocker
  - Disk imaging up to 5Gb/min
  - Internal storage mirroring and encryption
  - Free, Open source firmware
  - Fully customizable
  - Can be built for ~185USD
    - Comparable commercial kits ~1,500USD

FIREBrick Forensic Write Blocker

Open Source [Software] Tools

- Automated Network Triage (ANT)
  - Based on Ubuntu
  - Uses gPXE to boot systems over the network
  - Automates keyword and hash search on all network-booted systems
  - Basically a collection of bash scripts
  - Minor client kernel mod (no disk write)
  - More advanced than many systems available today
  - Free and Open Source... but Law Enforcement only

How GitHub has changed things

- GitHub has (unknowingly?) helped police get easier access to new software tools that can be used for their investigation
  - If they know how to look
- GitHub interface is (arguably) easier and more approachable than other versioning systems
- It is easier to get in contact with developers that started projects
- Unless you use the paid service, projects must be public
  - Academics likely to make most repositories public
  - Practitioners more likely to share code since GitHub is easy (depends on culture)
- BUT: contributing back is still a challenge

Linux and LE Education

- Linux / Tech. Education
  - Helps improve investigations (justice)
  - Help improve societies (trust)
  - Helps improve global economy (cooperation)

Linux and LE Education

- Global Linux / Open Source education for Law Enforcement is not easy:
  - Language
  - Time
  - Starting ability
  - Support
  - Cost
- Great course: edX – LFS101x.2 (Linux Foundation)
  https://www.edx.org/course/linuxfoundationx
  - Excitement from European LE
  - U.S. has good support
  - What about the rest of the world's LE? How can we include them?

Linux and LE Education

- Training courses:
  - Teach free, open source investigation tools for investigators
  - Usually very difficult at beginning
    - A lot of resistance (show us X commercial tool instead)
  - Commercial tools have associated certifications; home-grown FOSS investigation tools don't
    - What is the benefit to the investigator for taking extra time to learn Linux?

Advanced Cybercrime

- The (few) cybercrimes discussed in this presentation are nothing compared to the way Linux is being used and abused
  - Intelligence gathering
  - Cyber Warfare
  - Cyber Espionage
  - Government-sponsored attacks
- Governments are investing a lot in offensive security – not a lot in post-incident investigation

Conclusions

- Few Law Enforcement organizations (Govs) understand what Linux is, and what it can do for them
  - Power / Flexibility / Cost Reduction / Security
- Few Investigators are confident enough about their Linux abilities to support it (or FOSS) in court
- Linux support for LE needs to be more formalized than 'geek' interest communities
- Linux needs to be advocated to top-level Government officials / judges for better acceptance

Conclusions

Most importantly, a real community of Linux professionals - with a goal to include Law Enforcement - needs to be promoted and supported

- Such a community somewhat exists in U.S. and Europe
- Cybercrime is global, and Linux is the perfect tool to help fight it, regardless of available budgets

References

1) http://www.forbes.com/sites/gordonkelly/2014/03/24/report-97-of-mobile-malware-is-on-android-this-is-the-easy-way-you-stay-safe/

2) http://www.basistech.com/osdfcon/