Yocto Project/ OpenEmbedded Meets Security

Marta **Rybczynska**, Syslinbit

Embedded Linux Security: long time ago

Embedded (Linux) Security: 2020s

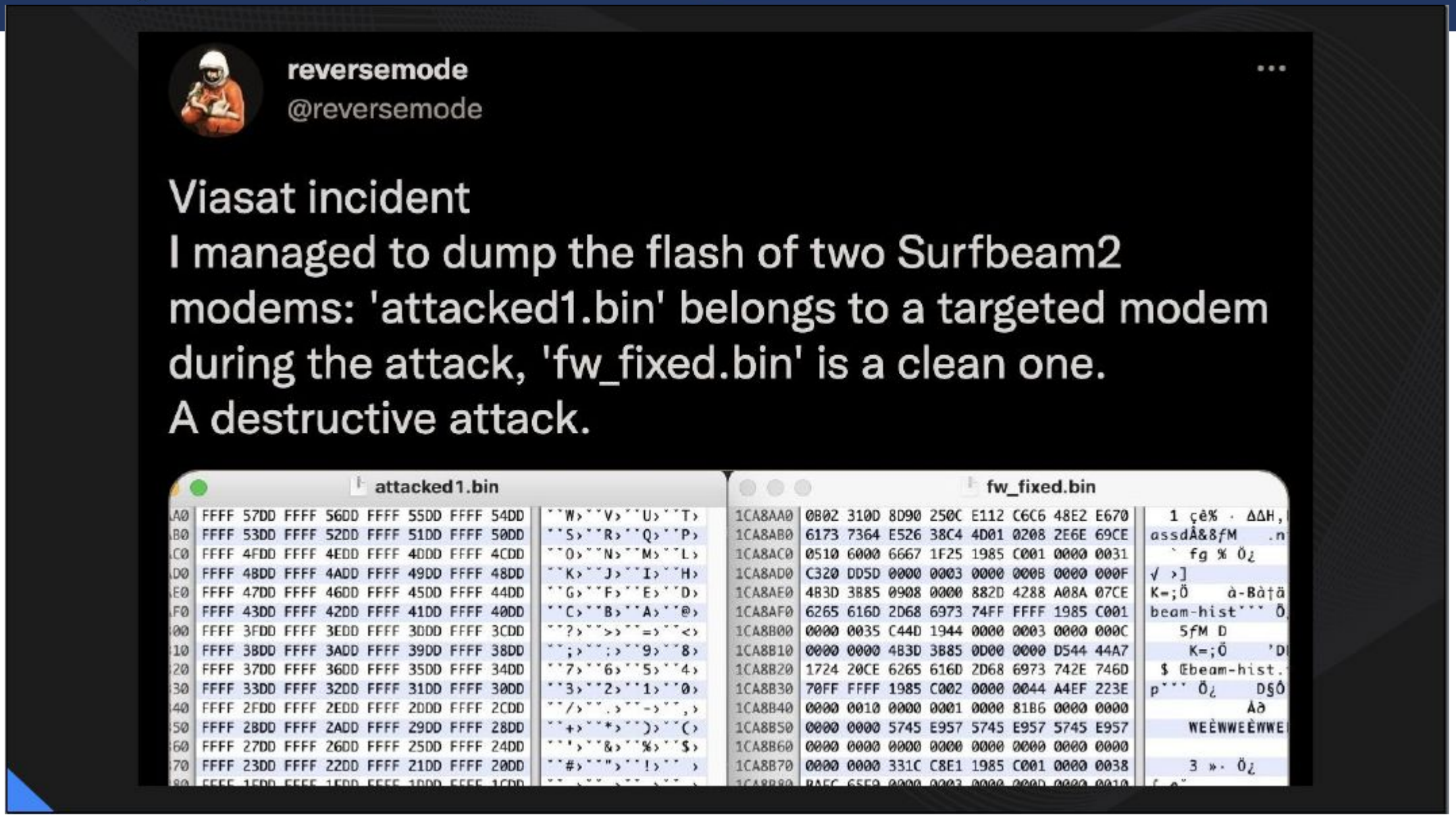
KA-SAT Network cyber attack overview

Viasat is providing an overview and incident report on the cyber-attack against the KA-SAT network, which occurred on 24 February 2022, and resulted in a partial interruption of KA-SAT's consumer-oriented satellite broadband service.

March 30, 2022 04:55 AM • Viasat, Inc.

Source: https://news.viasat.com/blog/corporate/ka-sat-network-cyber-attack-overview

Embedded (Linux) Security: 2020s



From:
Hegel and Guerro-Saade - “Real 'Cyber War': Espionage, DDoS, Leaks, and Wipers in the Russian Invasion of Ukraine”
Defcon 2022

Embedded (Linux) Security: 2020s

AcidRain

Targeted Device(s)	Description
/dev/sd*	A generic block device
/dev/mtdblock*	Flash memory (common in routers and IoT devices)
/dev/block/mtdblock*	Another potential way of accessing flash memory
/dev/mtd*	The device file for flash memory that supports fileops
/dev/mmcblk*	For SD/MMC cards
/dev/block/mmcblk*	Another potential way of accessing SD/MMC cards
/dev/loop*	Virtual block devices

From:
Hegel and Guerro-Saade - “Real 'Cyber War': Espionage, DDoS, Leaks, and Wipers in the Russian Invasion of Ukraine”
Defcon 2022

Embedded Linux Security: Questions

- Are your services running **lowest possible** permissions?
- Are your special devices (eg. flash) **protected from random services**?
- Do you **trace vulnerabilities** in your software stack?
- Can you **update** your software stack (without too much damage)?

EMBEDDED OPEN SOURCE SUMMIT

Embedded Linux Security: Kittens!

Product Liability Directive (PLD) update

Cyber Resilience Act (CRA)

Photo credits
https://www.flickr.com/photos/crsan/2571204698 Christian Holmér CC BY 2.0

Security Meets Yocto Project/OpenEmbedded

How do you **design secure devices** with Yocto Project/Open Embedded?

Phase 1: Creation
Phase 2: Configuration
Phase 3: Maintenance

Phase 1: Creation

Phase 2: Configuration

Phase 3: Maintenance

Phase 1: Creation

Follow best practices for YP:

- Follow “What I wish I’d known about Yocto Project”
  - https://docs.yoctoproject.org/dev/what-i-wish-id-known.html
- Use yocto-check-layer
  - Not only when applying to the Yocto Compatible Program
  - https://docs.yoctoproject.org/test-manual/yocto-project-compatible.html#validating-a-layer
- Read the docs - if you do not understand, ask!

Phase 1: Creation

Do NOT start from poky

- This is a common practice, but defaults not always safe
- Instead: create your own distribution

Phase 1: Creation

Do NOT perform direct changes to layers

- Perform changes in .bbappend files in your own layers

Phase 1: Creation

Choose 3rd party layers carefully

- Make sure it follows best practices
  - yocto-check-layers is a good test
- Verify if it is up to date
  - Recent commits, support for latest releases

Use meta-security

Phase 1: Creation
Phase 2: Configuration
Phase 3: Maintenance

Phase 1: Creation

Cut unneeded features

- Remove unneeded DISTRO_FEATURES
- Production image should not contain debug tools (eg. nfs, gdb, compilers…)
- Review your dependencies list

Phase 2: Configuration

When adding tools, follow (their) best practices

- Example: kubernetes or docker configuration is tricky

Phase 2: Configuration

Unique passwords for devices

- See another presentation on this subject

Phase 2: Configuration

Apply hardening

- Use separate users for each important service
- Compiler flags /openembedded-core/meta/conf/distro/include/security_flags.inc
  - This one is included in poky!
- Lower permissions of files
  - meta-security/meta-hardening

Phase 1: Creation
Phase 2: Configuration
Phase 3: Maintenance

Phase 2: Configuration

CVE-checking in 2022

- Possible to check the complete set of layers with “cve-check”
  - INHERIT += “cve-check”
- Using NVD format https://nvd.nist.gov/vuln/detail/CVE-????-?????
- Text or JSON output formats
- Image or complete build

Phase 2: Configuration

Changes in 2023

- NVD database old format going down in September 2023 (*)
- CVE 5.0 format launched
  - https://github.com/CVEProject/cvelist

Phase 2: Configuration

YP CVE checking changes in 2023

- New fetcher using NVD new format
  - master and mickledore: enabled by default
  - kirkstone, dunfell: not ported yet
- Work on management of kernel CVEs
  - Multiple issues per week, often missing information in NVD
- A proposal pending to rework CVE_CHECK_IGNORED

Phase 1: Creation
Phase 2: Configuration
Phase 3: Maintenance

What's Next

- More vulnerability fetchers
  - Kernel CVEs
- Vulnerability checker and SPDX post-processing
- meta-hardening rework as a DISTRO_FEATURE

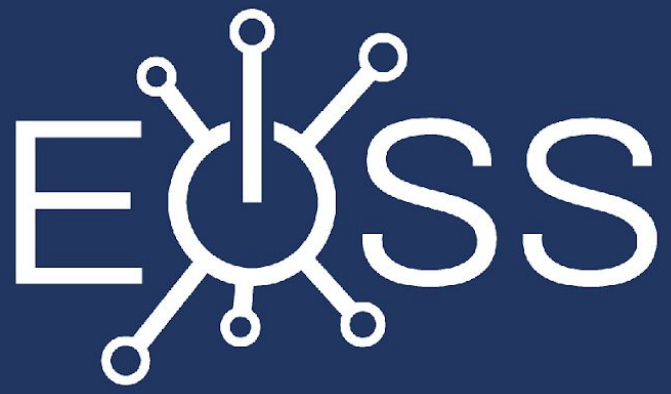
EMBEDDED OPEN SOURCE SUMMIT

Yocto Project/ OpenEmbedded Meets Security

Marta **Rybczynska**, Syslinbit

Embedded Open Source Summit 2023

#EMBEDDEDOSSUMMIT



EMBEDDED
OPEN SOURCE
SUMMIT