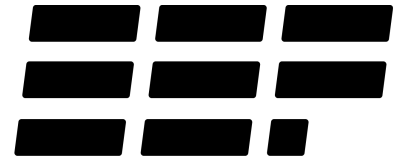
How the Erlang Ecosystem is Leaning Into Better Cybersecurity

Kiko Fernandez-Reyes & Alistair Woodman.
Erlang Ecosystem Foundation.
(EEF) (erlef.org)

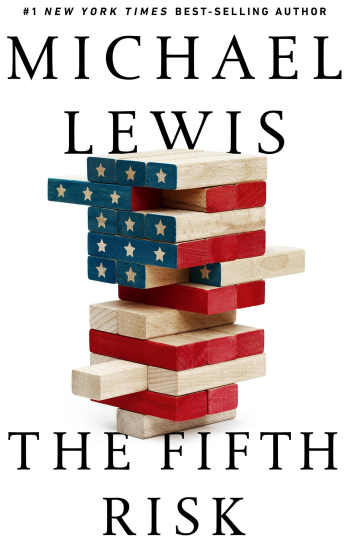


ERLANG ECOSYSTEM FOUNDATION

Agenda

- Indirection #1: Michael Lewis; Renowned Author
- Indirection #2: Christopher Mark;
  A Service to America Medals® honoree
- Indirection #3: Coal Mine Safety
- Importance of Erlang & BEAM
- EEF's Plans

The Fifth Risk (2018)



…John MacWilliams, a risk management expert at the United States Department of Energy (DoE) from the Obama Administration, gave Michael Lewis the top five risks he saw for the department:

1) Broken arrows (loose nukes and nuclear accidents),
2) North Korean nuclear weapons,
3) An end to the Iran nuclear deal,
4) Protecting the electrical grid from cyberterrorism, and
5) Internal project management.

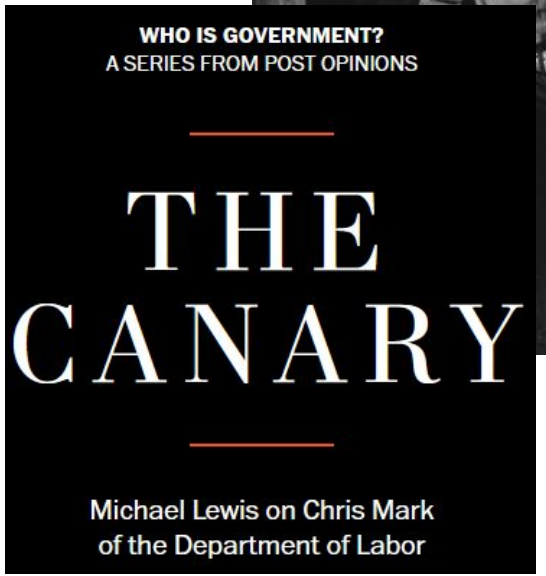
It is this ***fifth*** risk that inspired the title of the book.

https://en.wikipedia.org/wiki/The_Fifth_Risk

ERLANG ECOSYSTEM FOUNDATION

Recent Washington Post Opinion Series

1) As a result of writing The Fifth Risk, Michael Lewis and the Washington Post decided to run a series of articles about “Unsung Heros” in the Federal Government.
2) One of the first, published on September 3rd 2024, covers Chris Mark and his work over the last 50 years to improve mine safety…



https://www.washingtonpost.com/opinions/interactive/2024/michael-lewis-chris-marks-the-canary-who-is-government/

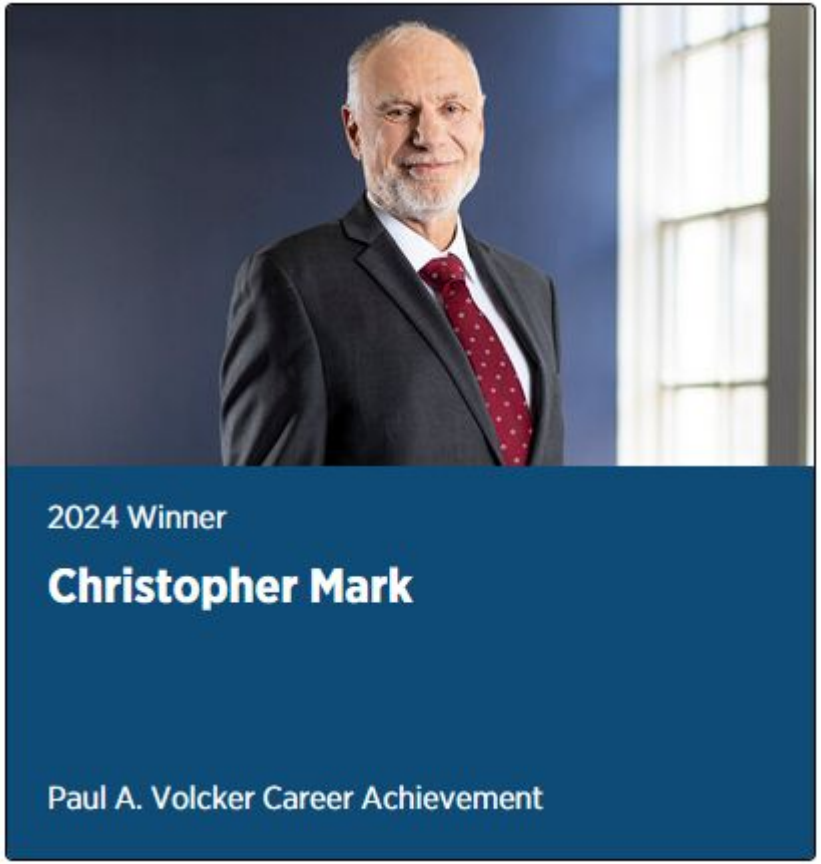
ERLANG ECOSYSTEM FOUNDATION

SAMUEL J. HEYMAN
SERVICE TO AMERICA MEDALS®

PARTNERSHIP FOR PUBLIC SERVICE

The ‘Sammie’ Awards

1) Christopher Mark
2) 2024 Lifetime achievement honoree
3) …Over a decades-long career, Mark developed computer software packages that contain guidelines routinely used by mine operators to develop and evaluate mining plans for most underground coal mines in the U.S. A world-renowned expert, he’s credited with saving an untold number of miners’ lives.



https://servicetoamericamedals.org/honorees/christopher-mark/

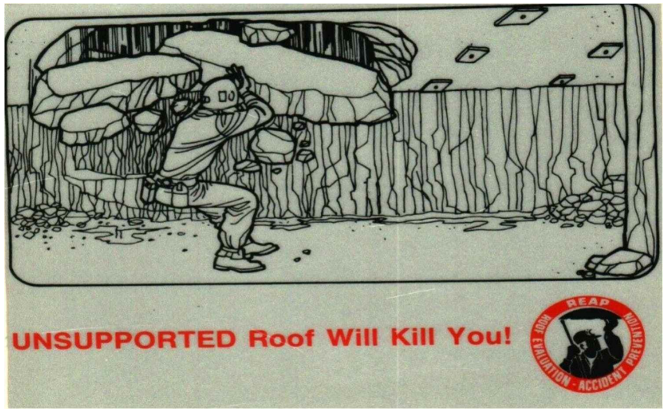
The Road to Zero: The 50-Year Effort to Eliminate Roof Fall Fatalities from US Underground Coal Mines

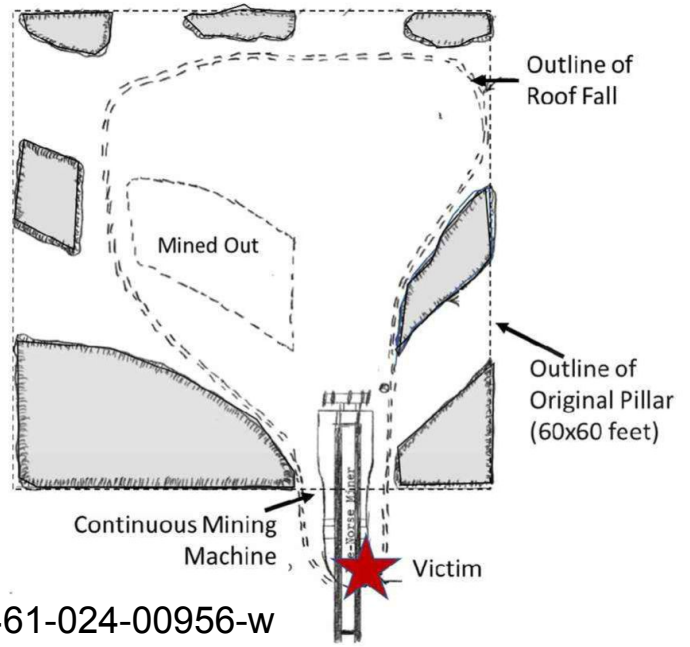
- Six decades ago, the **most dangerous job in the USA was mining coal underground**. Roof falls were responsible for half of the deaths, killing about 100 miners every year. **Fast forward to 2016 and zero roof fall fatalities**. Just three miners were killed by roof falls during the following 6 years. How did the mining community achieve this historic goal?
- This paper starts by analyzing the roof fall fatalities in 1968, categorizing them by their fundamental cause. Then, it shows how each type of roof fall was reduced over time, using snapshots of the fatalities occurring in subsequent decades. Along the way, it evaluates the influence of the regulatory environment, changing mining methods, and better ground control technology.
- The study found that in 1968 **more than half of roof fall fatalities at large mines were attributable to an inadequate safety culture**. The immediate effect of the 1969 Coal Mine Health and Safety Act was to reduce the riskiest activities, like needlessly going under unsupported roof. Other hazards, like large roof falls, required technological developments before they were brought under control. Roof Control Plans, which the US Bureau of Mines had been advocating since the 1920s, played a significant role throughout the process.

C. Mark: Mining, Metallurgy & Exploration https://doi.org/10.1007/s42461-024-00956-w

Pictures worth 1K words…

Roof Falls

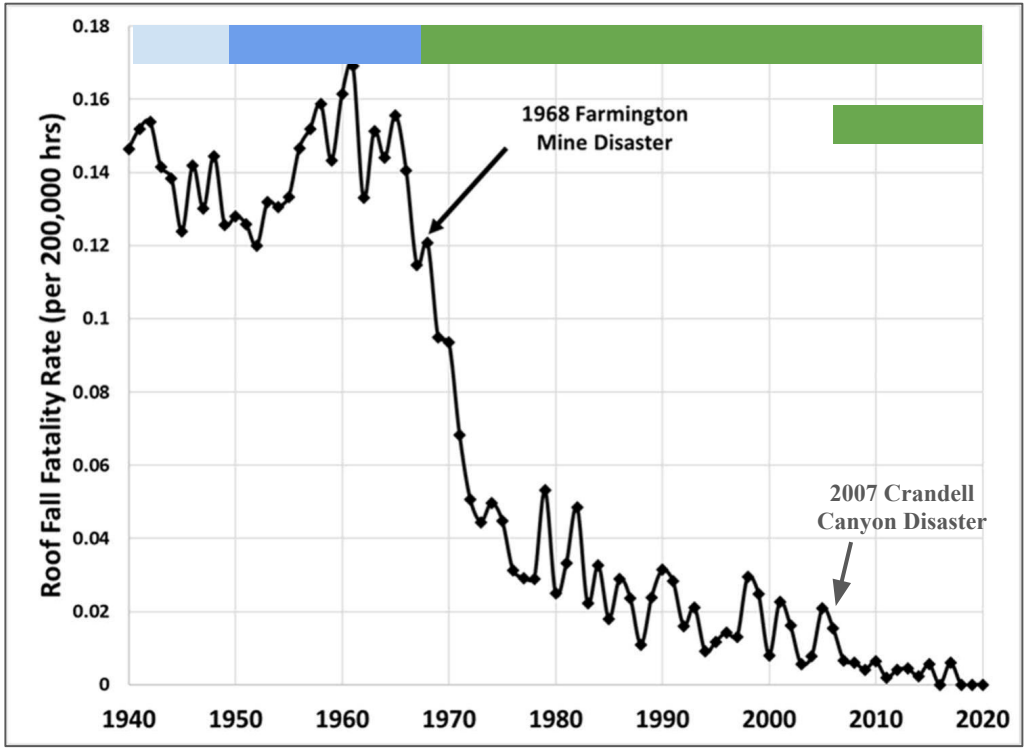




C. Mark: Mining, Metallurgy & Exploration https://doi.org/10.1007/s42461-024-00956-w

Fatality Rates in US Coal Mines

- 1940s Switch to Roof Bolting started
- 1950s Almost full conversion to Roof Bolting
- Late 1950s and early 1960s fatality rates worsen slightly
- 1968 Disaster & Hearing
- 1969 Enforcement allowed
- 2007 Disaster & Oversight
- 2016 first year with no deaths



C. Mark: Mining, Metallurgy & Exploration https://doi.org/10.1007/s42461-024-00956-w

Summary

1) ***Appropriate*** legislation brings benefits that were omitted by the market or present behavior.
2) If you are doing things competently, not much need to worry
3) If you were not, then start to work towards better cyber security

Importance of Erlang & BEAM VM

- Functional programming language
- Distributed programming
- Concurrent & Parallel
- Fault-tolerant
- On-the-fly updates
- Soft real-time constraints

ERLANG ECOSYSTEM FOUNDATION

Importance of Erlang & BEAM

Do you like to do **phone calls**?

Do you like to use **Klarna**?

Do you **receive official mail** via Kivra?

What about **chatting** on WhatsApp?

Do you play **games**?

Do you like the **internet**?

ERLANG ECOSYSTEM FOUNDATION

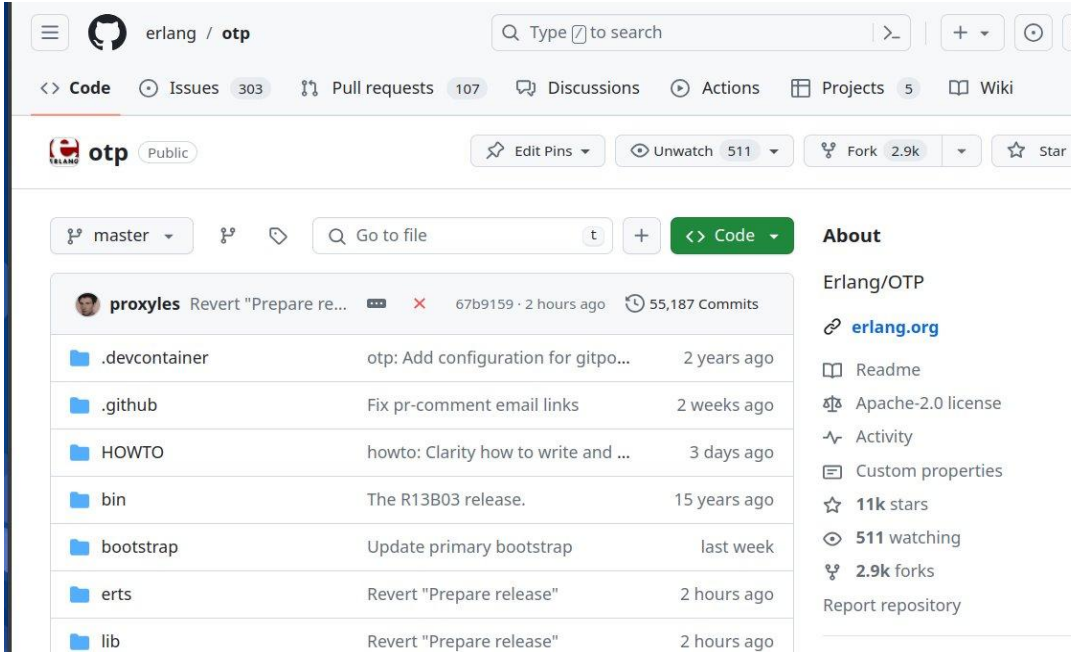
Importance of Erlang & BEAM

Issues: 2500+

PRs: 3263

Battle-tested by WhatsApp, Klarna, Cisco, Riot Games, Pinterest, etc

Community around Erlang
- Detection of issues
- Contributions with Pull Requests:
  - Documentation fixes
  - Improvements to libraries
  - Bug fixes



Importance of Erlang & BEAM

Klarna: EEP and PR for map-comprehension

Klarna: implement Draft-06 of JSON schema validation

99s: HTTP/2 and REST API libraries

AdRoll: Dead-code removal

VMWare: message broker RabbitMQ

WhatsApp: json, eqWAlizer type system, incremental mode to Dialyzer (x7 speedup)

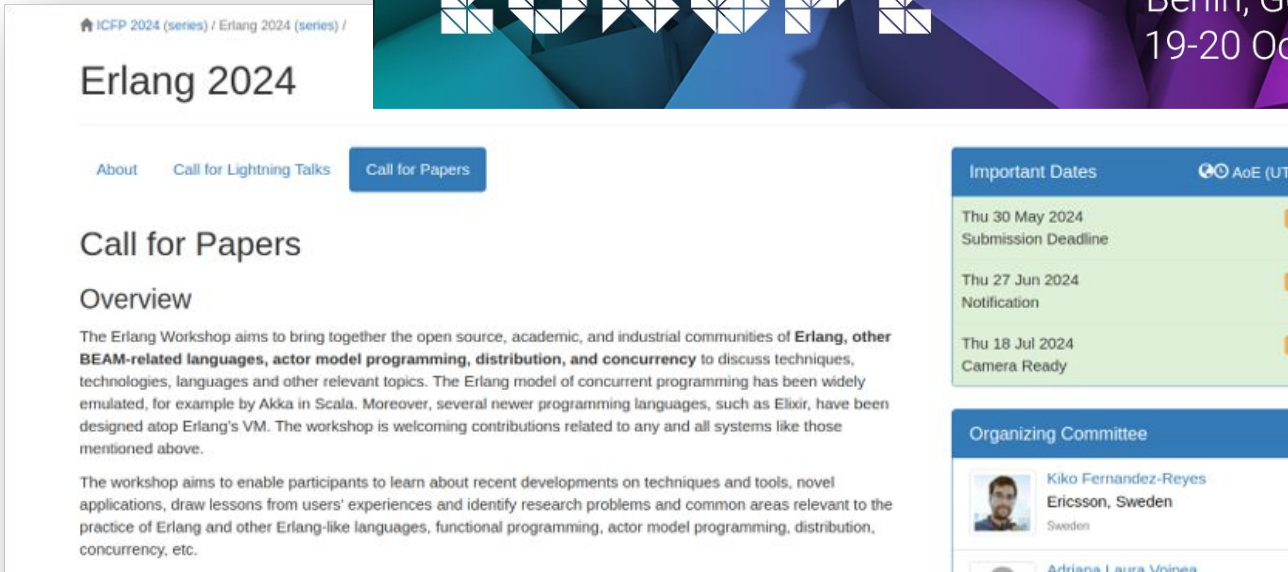
Plataformatec: Elixir language

...

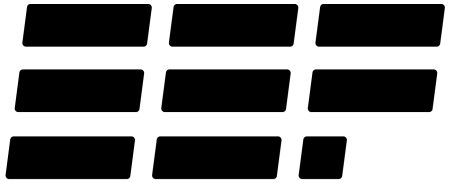
ERLANG ECOSYSTEM FOUNDATION

Importance of BEAM

- Erlang Workshop
- Code Europe
- Code AMERICA
- Code BEAM SF



Who are the Erlang Ecosystem Foundation (EEF) ?



ERLANG ECOSYSTEM FOUNDATION

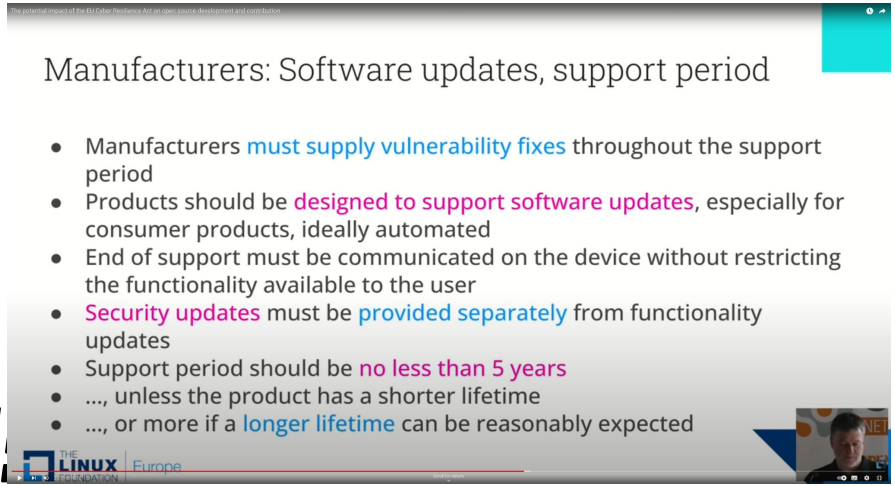
ERLANG

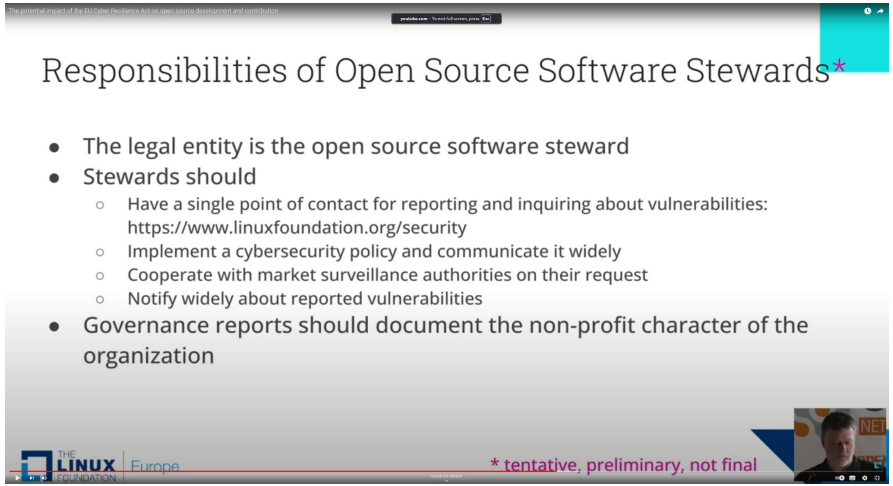
1) California registered 501(c)3 (similar to gGmbH)
2) Founded in 2019
3) Membership Organization (Nominal yearly dues)
4) Funded mostly by Company Sponsors
5) The BEAM VM supports:
   a) Erlang
   b) Elixir
   c) Gleam
   d) Lua
   e) Lisp

https://erlef.org/

Summary of CRA

1) LFE Broadcasting
2) Yesterday's Presentations





ERLANG ECOSYSTEM FOUNDATION

https://www.youtube.com/watch?v=uOk4WIFddsc

Possible outcomes of the CRA…

1) The EU CRA standards & policies will be too harsh and the law becomes a dead letter.
2) The costs for many of the small O/S players become too large and the O/S big players take over.
3) Somehow the supply chain and open-source projects adjusts to support CE marks. Commercial Open-Source projects will need better mechanisms of capturing funding for the value they create… Any Suggestions ?

ERLANG ECOSYSTEM FOUNDATION

What the EEF plans to do

1) Increase engagement with Civil Society organizations
2) Increase engagement with Vertical and Horizontal Industry organizations
3) Provide educational outreach inside our own community
4) Raise funding
5) Develop compliance processes and tools to pass the new EU and US standards

ERLANG ECOSYSTEM FOUNDATION

Standards and Processes we will focus on

1) OpenChain Project Compliance
2) NIST's SSDF
3) SBOM support
    1) SPDX and
    2) CycloneDX
4) Static tooling of known BEAM vulnerabilities
   (automated checking of EEF Security group guidelines)
5) CI/CD tooling, monitoring CVEs and vulnerabilities

OpenChain Project Compliance

- OpenChain ISO/IEC 5230:2020 helps organizations manage open source licensing requirements for past, current and future products or services

Q: How do I trust my open source supply chain?

- OpenChain Security Assurance Specification (ISO/IEC DIS 18974:2023)

OpenChain Project Compliance (ISO/IEC DIS 18974)

4.1.5 Standard practice implementation

The program shall demonstrate sound and robust handling **procedures of known vulnerabilities** in supplied software by the following procedures:

- Method to **identify structural and technical threats** to the supplied software;
- Method for **detecting existence of known vulnerabilities** in supplied software;
- Method for following up on **identified known vulnerabilities**;
- Method for **analyzing supplied software** for newly published known vulnerabilities post release of the supplied software;

OpenSSF Scorecard:

Assesses open source projects for security risks through a series of automated checks

WIP Static detection of known vulnerabilities per EEF security group guidelines

ERLANG ECOSYSTEM FOUNDATION

OpenChain Project Compliance (ISO/IEC DIS 18974)

4.1.5 Standard practice implementation

- Method for **continuous and repeated security testing** to be applied for all supplied software before release;
- Method to **verify that identified risks will have been addressed** before release of supplied software;
- Method to **export information about identified risks** to third parties as appropriate.

Erlang Ecosystem Foundation will focus on:

- CI/CD tooling, monitoring CVEs, and vulnerabilities

OSV: A distributed vulnerability database for Open Source

ERLANG ECOSYSTEM FOUNDATION

OpenChain Project Compliance (ISO/IEC DIS 18974)

4.3 Open source software content review and approval

4.3.1 Software bill of materials
A process shall exist for **creating and maintaining a bill of materials** that includes each open source software component from which the supplied software is comprised.

Erlang Ecosystem Foundation will focus on:

- Automatic Creation of SBOM (Soft. Bill of Materials)

ERLANG ECOSYSTEM FOUNDATION

Develop compliance processes and tools

1) C/C++ Compiler options

2) Safe Erlang/Elixir/BEAM compiler and security defaults

   We cannot forbid all unsafe behaviour,
   but you can opt-in to unsafe behaviour

3) Existing NIFs may remain in C/C++, new NIFs should be written in memory safe languages (e.g., Rust, Ada, etc)

Long-term Plans & Academic Collaborations

1) Improving static tooling to detect more typing errors
   Erlang/OTP team interacts with developers of type systems to improve the number of tools that work on Erlang (eqWAlizer, etylizer, gradualizer)

2) Compiler Verification Efforts to verify that compilation optimisations are semantics preserving

3) Security and energy efficiency

Closing Remarks

- Erlang Ecosystem Foundation as open source steward
- Erlang (BEAM) is:
  - EU language, created in Sweden,
  - Open source,
  - Ericsson has a team that maintains it
  - Critical to the Swedish infrastructure
    - Banking (Klarna)
    - Telecommunications (Ericsson, CISCO, Telia, etc)
    - Message industry (WhatsApp, Kivra, etc)
- EEF will guide efforts to be CRA compliant

ERLANG ECOSYSTEM FOUNDATION