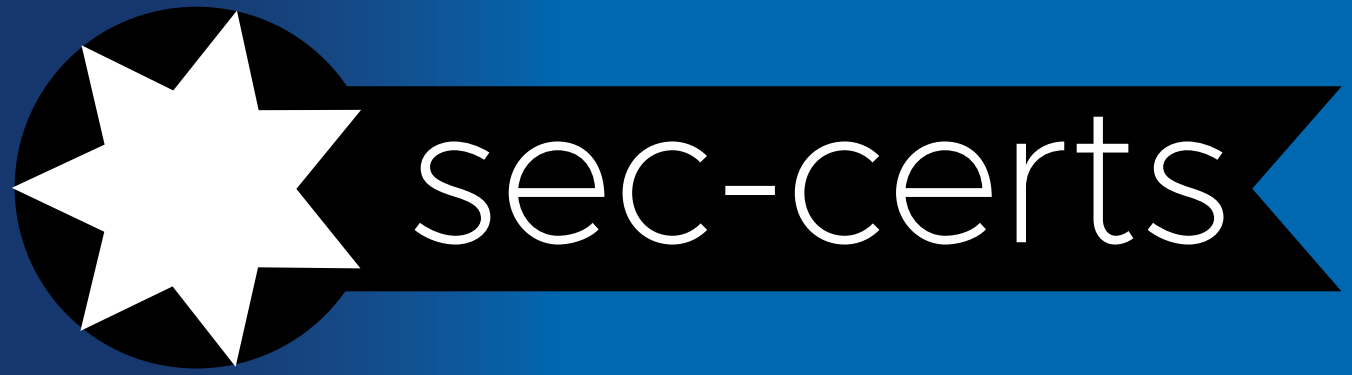

sec-certs: Insights from the world of certified computer security products and systems

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CROCS
Centre for Research on Cryptography and Security

COMMON CRITERIA 101

CC – going for evaluation (in a nutshell)

1. Define the product/system for evaluation
2. Specify its functionality
3. Specify the assurance level claimed
4. See details of evaluation with a certification body
5. Prepare evidence

Common Criteria – two catalogues

- Two catalogues of components for specification of assurance and functionality requirements, with a standard terminology.
- *Functionality* – rules governing access to & use of TOE resources, and thus information and services controlled by the TOE
- *Assurance*
  - grounds for confidence that a TOE meets the SFRs (CC v3.1)
  - 7 levels (EAL1 < EAL7)
  - Hierarchical system – higher or new components

Common Criteria

- Interests of users, manufacturers, evaluators
- *Target of evaluation* (TOE) – what is (to be) evaluated
- *Protection profile (PP)* (smartcards, biometrics, etc.)
  – Catalogued as a self-standing evaluation document
- *Security target* (ST) – theoretical concept/aim
- *Security Functional Requirements* (SFRs) – individual security functions provided by the TOE

- **Evaluation of TOE – is the reality corresponding to theory (ST)?**

Common Criteria – certified products/systems

- FIPS 140
  - 5000+
    - 950–1000 active today

1851 Certified Products by Category *		
Category	**Products**	**Archived**
Access Control Devices and Systems	22	138
Biometric Systems and Devices	2	3
Boundary Protection Devices and Systems	39	225
Data Protection	46	206
Databases	10	88
Detection Devices and Systems	6	74
ICs, Smart Cards and Smart Card-Related Devices and Systems	755	1437
Key Management Systems	7	51
Mobility	44	90
Multi-Function Devices	240	502
Network and Network-Related Devices and Systems	234	707
Operating Systems	41	208
Other Devices and Systems	327	827
Products for Digital Signatures	51	134
Trusted Computing	27	56
Totals:	**1851**	**4746**
	Grand Total:	**6597**

Common Criteria

NIST FIPS 140-2/3

NVD vulnerability database
https://nvd.nist.gov/

Base Score: 8.8 HIGH

National Certificate Authorizing Schemes (BSI, ANSSI, NAIP…)

Certified product

Vendor

Evaluation laboratory

NIST CMVP (Cryptographic Module Validation Program)
https://csrc.nist.gov/Projects/cryptographic-module-validation-program/

Common Criterial Certification portal
https://www.commoncriteriaportal.org/

NIST CMVP portal

List of platforms and vulnerabilities (CPE, CVE)

Certification artifacts (Certificate, Security Target, Security Policy…)

sec-certs

sec-certs git repository
https://github.com/crocs-muni/sec-certs

sec-certs webpage
https://sec-certs.org/

Extracted data (JSON)

sec-certs API
Python CLI, Jupyter Notebooks, Binder, Docker

Analyses and visualizations

Let us show you (1) simple search and (2) LLM-based chat

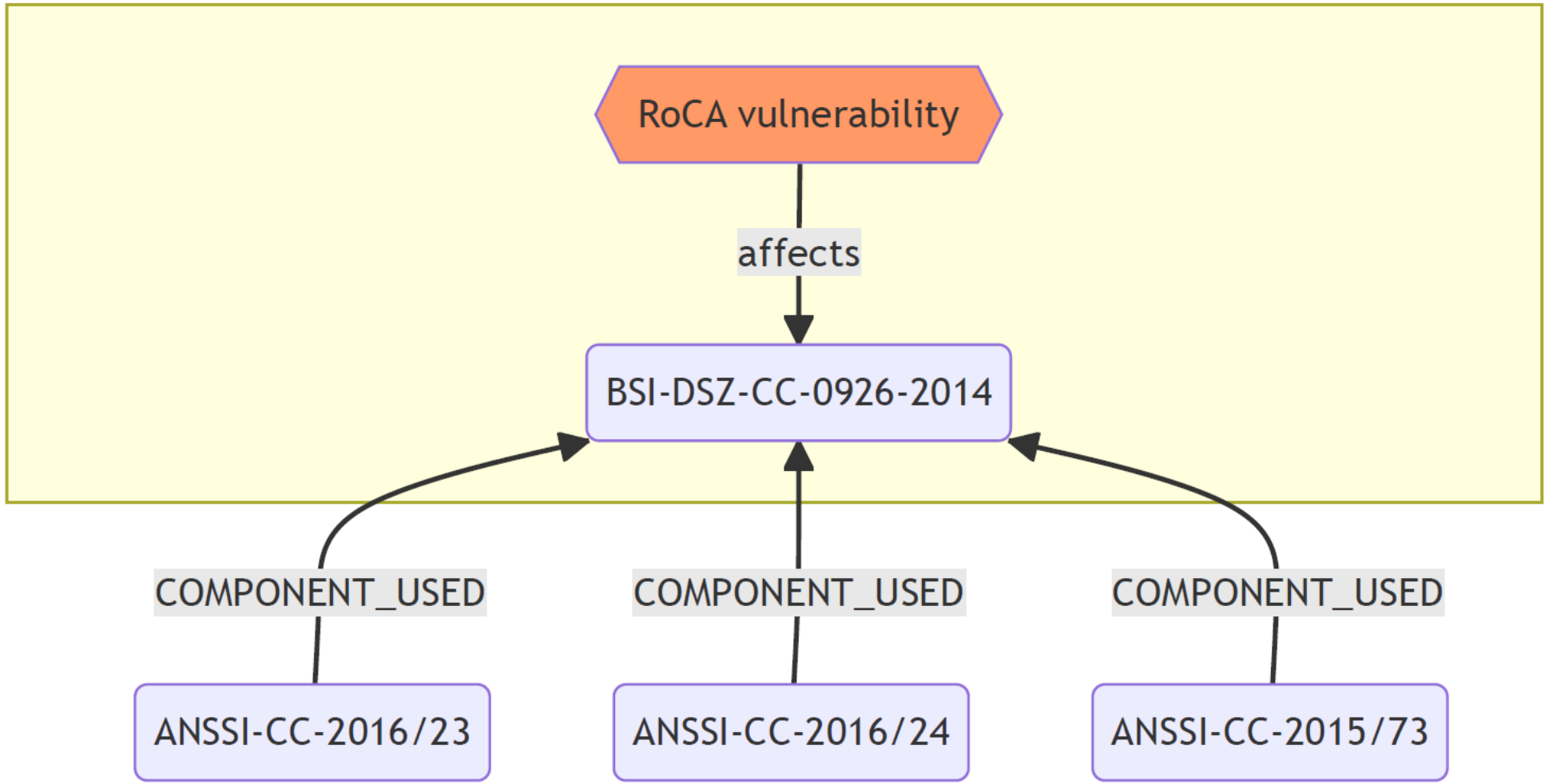
WHY DID WE CARE (AGAIN) ABOUT CC?

CVE-2017-15361 (RoCA)

- [CVE-2017-15361]: practical factorization of certain RSA keys.
- Billion+ devices affected.

- ⚠️ How many products certified under Common Criteria are impacted?

CVE-2017-15361

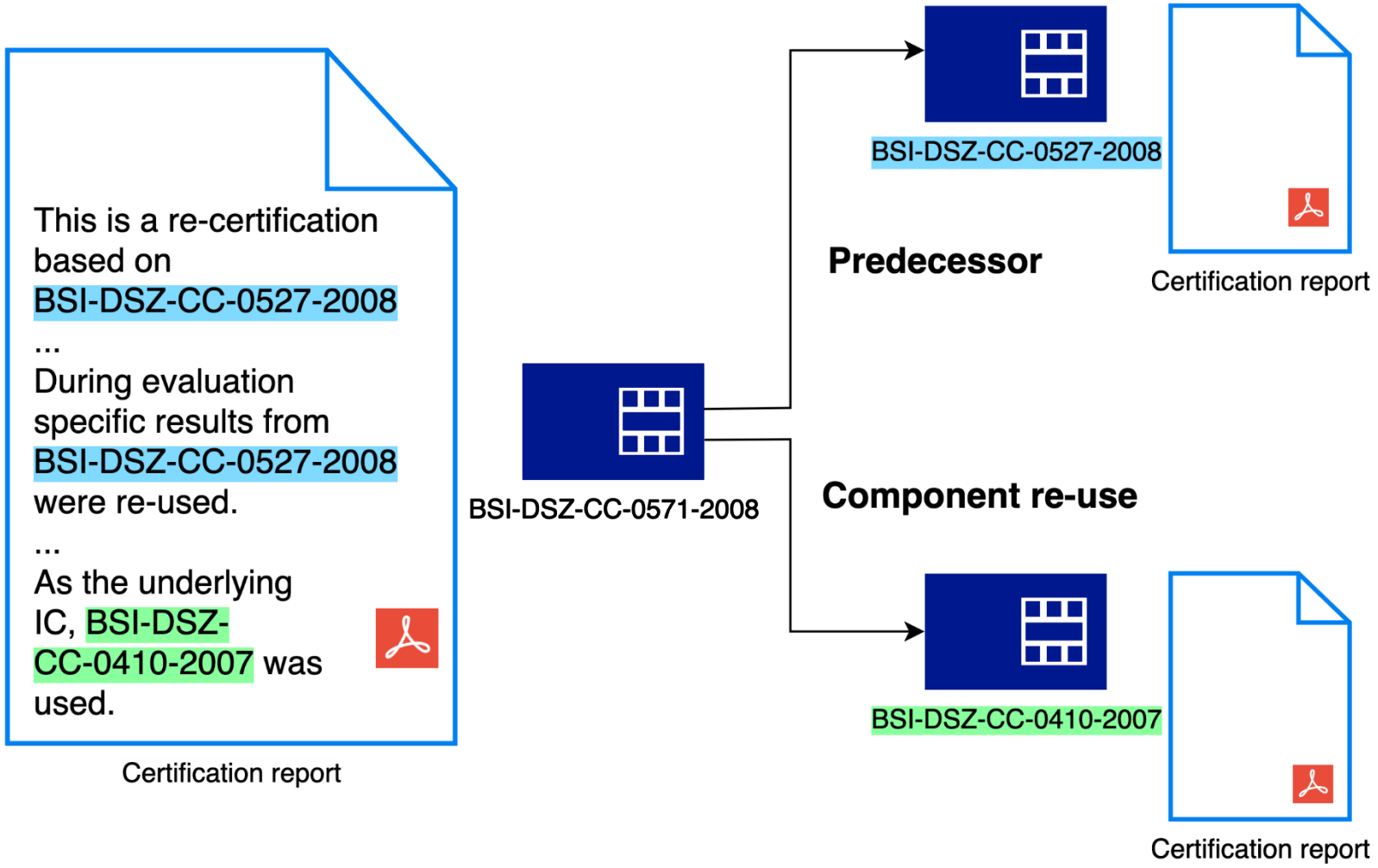


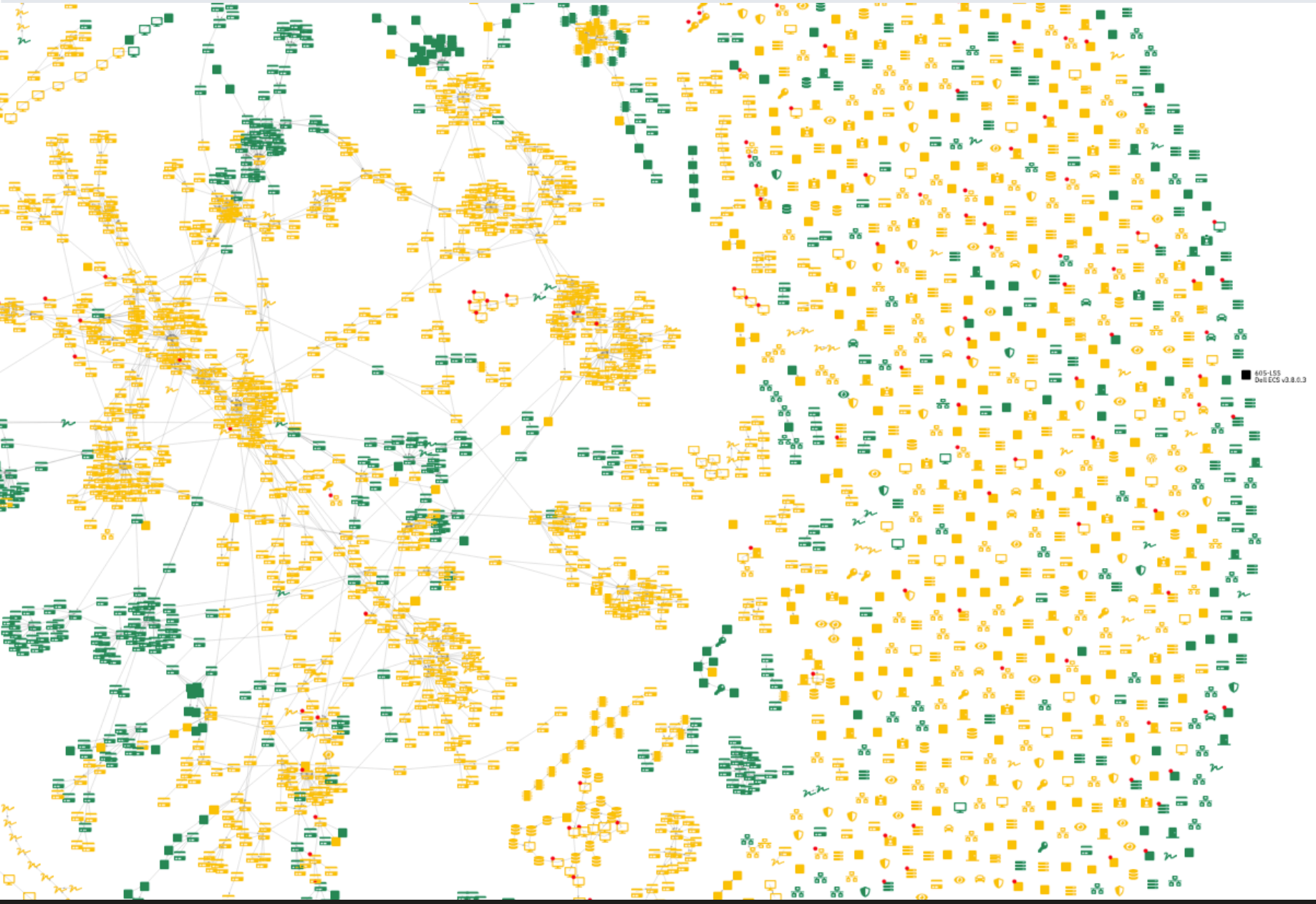
REFERENCES, REFERENCES, REFER…

Building the reference graph

- Each device is a **vertex**.
- A reference from device A to device B is a **directed edge**.
  - The reference is indicated by the presence of a foreign certificate ID within the artifacts.
- The categorical context of the reference, e.g. `COMPONENT_USED`, is an **edge label**.
- We worked with 5780 vertices and 3007 edges.

Building the reference graph




605-LSS
Dell ECS v3.8.0.3

Few major observations from reference analyses

- Top-10 products are used in 16% of all active smartcards.
  - These are microcontrollers, typically with cryptographic functionality.
- Higher reach is positively associated with higher evaluation assurance level.
- A vulnerability in cryptographic functionality would spread from high-reach devices to approx. 70% of their dependants.
  - Affecting 50+ certified products, RoCA was not an outlier.

What if you need help answering questions like

- What processor architectures are commonly used in certifications/products of interest?
- How do we compare with our competitors (their certified products)?
- Check how long evaluations take for certain labs, types of products, etc.

Let us see how (3) how two CC certificates differ.

Users of the sec-certs.org tool

- Owners/users of certified devices / security researchers
  - What security claims are made?
  - What certificates to additionally monitor?
  - Notification after new (possibly relevant) vulnerability is found
  - Analyze impact of vulnerability (e.g., ROCA case)
- Vendors of certified products
  - Are we under/over certifying with respect to competition?
  - Who is certifying products of our type and what were requirements in past?
- Certification bodies
  - Performance of labs, suspiciously short validity, non-standard cert. claims…
  - Impact of certification requirements (SARs) on the actual security

Users of the sec-certs.org tool

- Certification laboratories
  - Are we comparable with other laboratories? What are the trends?
- Government agencies & corporations
  - Processing additional non-public documents
  - Attaching additional metadata (test results, powertrace…) and its governance
    - Generate sec-certs “web” locally with additional information
- General public
  - Easy access to information (interactive webpage, info from multiple sources…)
  - Ecosystem insights: What is standardized? Change in time?

Main functionality of *sec-certs.org* project

- Fulltext search over all CC and FIPS 140 certificates
- Continuous insight into certification ecosystem
- Extracted graph of references between certificates
- Mapping to NIST National Vulnerability Database (CVEs)
- Automatic notification of events for observed certificates (RSS feed)
- Correlation of certification requirements and vulnerability occurrence
- Python API for custom queries, preprocessed datasets for downloads
- Connecting additional metadata about certified items (tests, information)
- Local processing with inclusion of non-public documents

(4) Automatic updates from sec-certs & (5) Dashboarding

In a nutshell

- We have developed a pipeline for automated processing of Common Criteria artifacts.
  - We also cover FIPS 140 and NVD vulnerability DB.
  - Mapping of dependencies among certificates
  - Continuous insights into certification ecosystem
  - Support for more transparency in security certifications

- The analysis is tedious due to artefacts *produced by humans and meant to be consumed by humans*.

Thank you for your attention!

sec-certs

Cyber Security for Europe

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Cyber-security Excellence Hub in Estonia and South Moravia

Red Hat

CAT

CYBERSECURITY CERTIFICATION AND ASSESSMENT TOOLS

Come and play – with sec-certs!

https://sec-certs.org/

Journal articles: