What's In Your AI Code?

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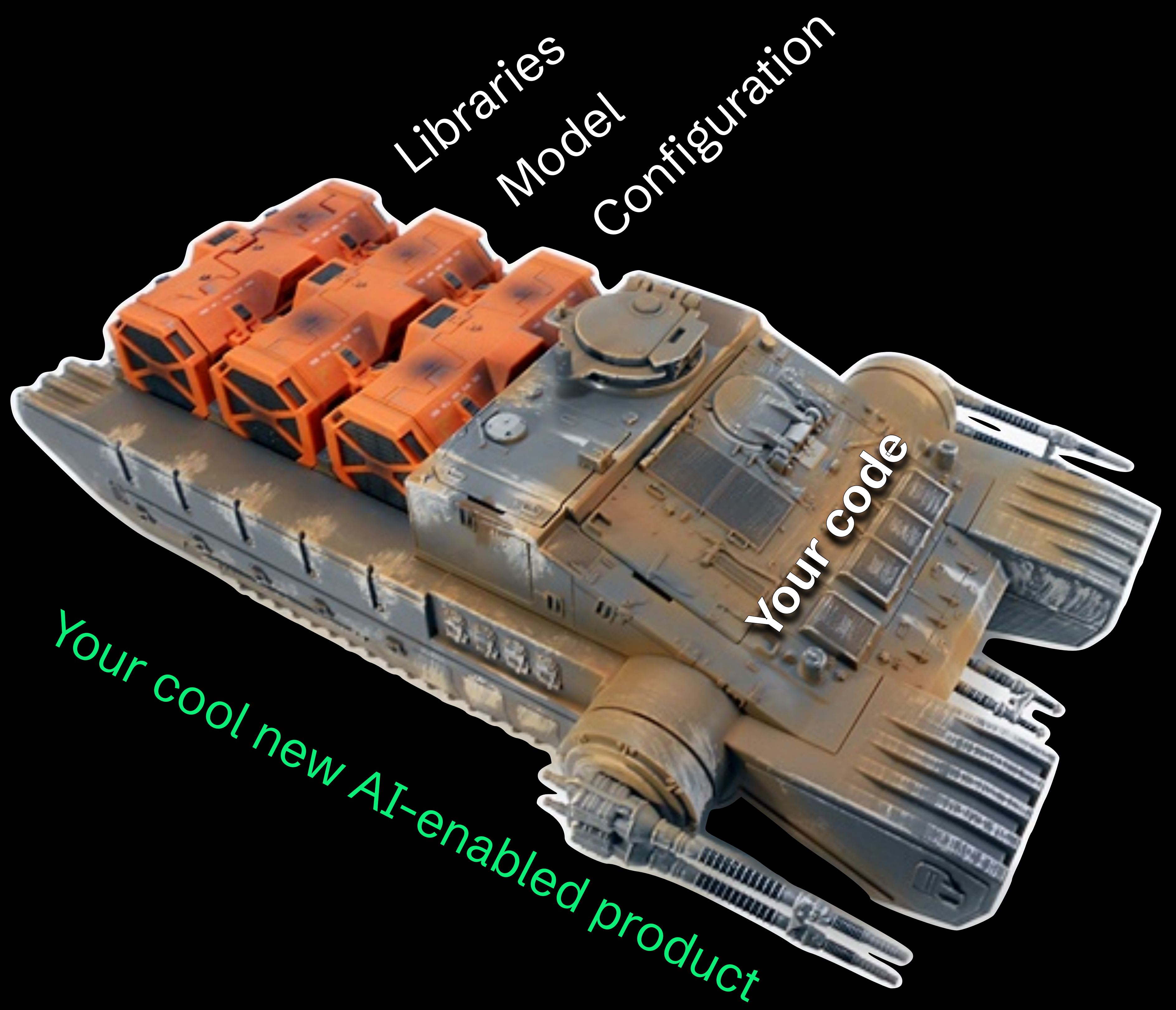
Darren Meyer, Staff Research Engineer — 26. June 2024

What do we mean by "AI Code"?



How dependencies work

Package Managers and Runtimes tend to operate completely decoupled, like ships passing in the night

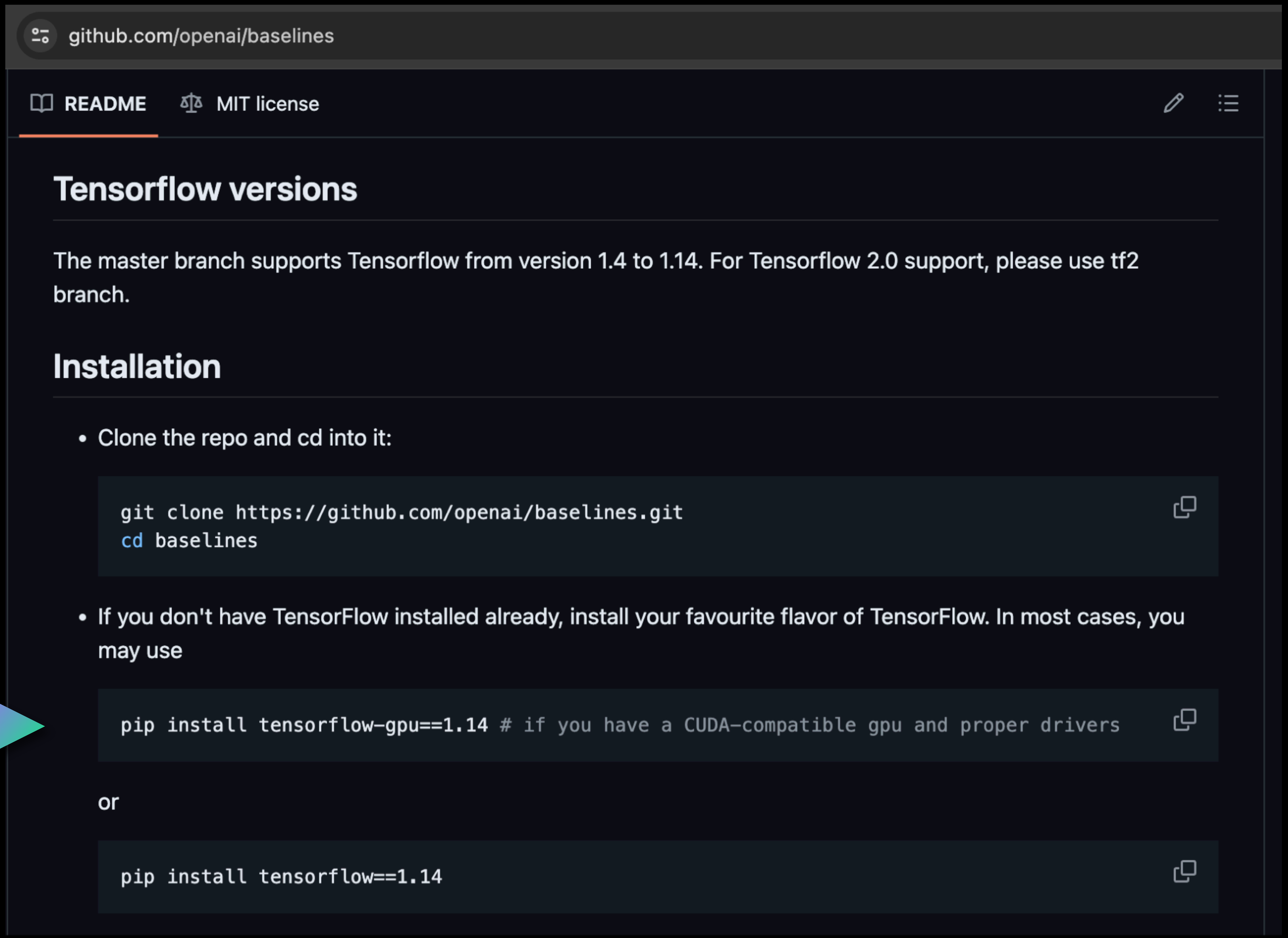
1. Developer starts a new project that uses a couple of dependencies
2. Developer creates a manifest file to declare the two direct dependencies (requirements.txt, package.json, pom.xml, etc.)
3. Build system runs package manager and the direct dependencies bring along several other transitive dependencies
4. Package manager copies the files in a directory
5. Runtime/compiler loads dependencies as needed during execution

Things get out of sync

It is unavoidable

- Developers import new dependencies without updating the manifest file (possible in python, Javascript, scripts etc)
- In some cases dependencies are there in the environment (like global python or node packages)
- In some cases dependencies are for testing/dev (example: storybook in Javascript)
- In some cases dependencies are removed from the code but not from the package manager manifests

Your manifest can lie


github.com/openai/baselines

README MIT license

Tensorflow versions

The master branch supports Tensorflow from version 1.4 to 1.14. For Tensorflow 2.0 support, please use tf2 branch.

Installation

- Clone the repo and cd into it:

```
git clone https://github.com/openai/baselines.git
cd baselines
```

- If you don't have TensorFlow installed already, install your favourite flavor of TensorFlow. In most cases, you may use

```
pip install tensorflow-gpu==1.14 # if you have a CUDA-compatible gpu and proper drivers
```

or

```
pip install tensorflow==1.14
```

OpenAI’s Baselines library

- “Just `pip install` a dep”
- Baselines *won’t function without the right version*
- You’ll never see it in a manifest or lock file
- SCA / dep tree tools (usually) won’t see it

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Models suggest this pattern often

huggingface.co/amazon/MistralLite

How to Use MistralLite from Python Code (HuggingFace transformers)

Important - For an end-to-end example Jupyter notebook, please refer to this link.

Install the necessary packages

Requires: transformers 4.34.0 or later, flash-attn 2.3.1.post1 or later, and accelerate 0.23.0 or later.

```
pip install transformers==4.34.0
pip install flash-attn==2.3.1.post1 --no-build-isolation
pip install accelerate==0.23.0
```

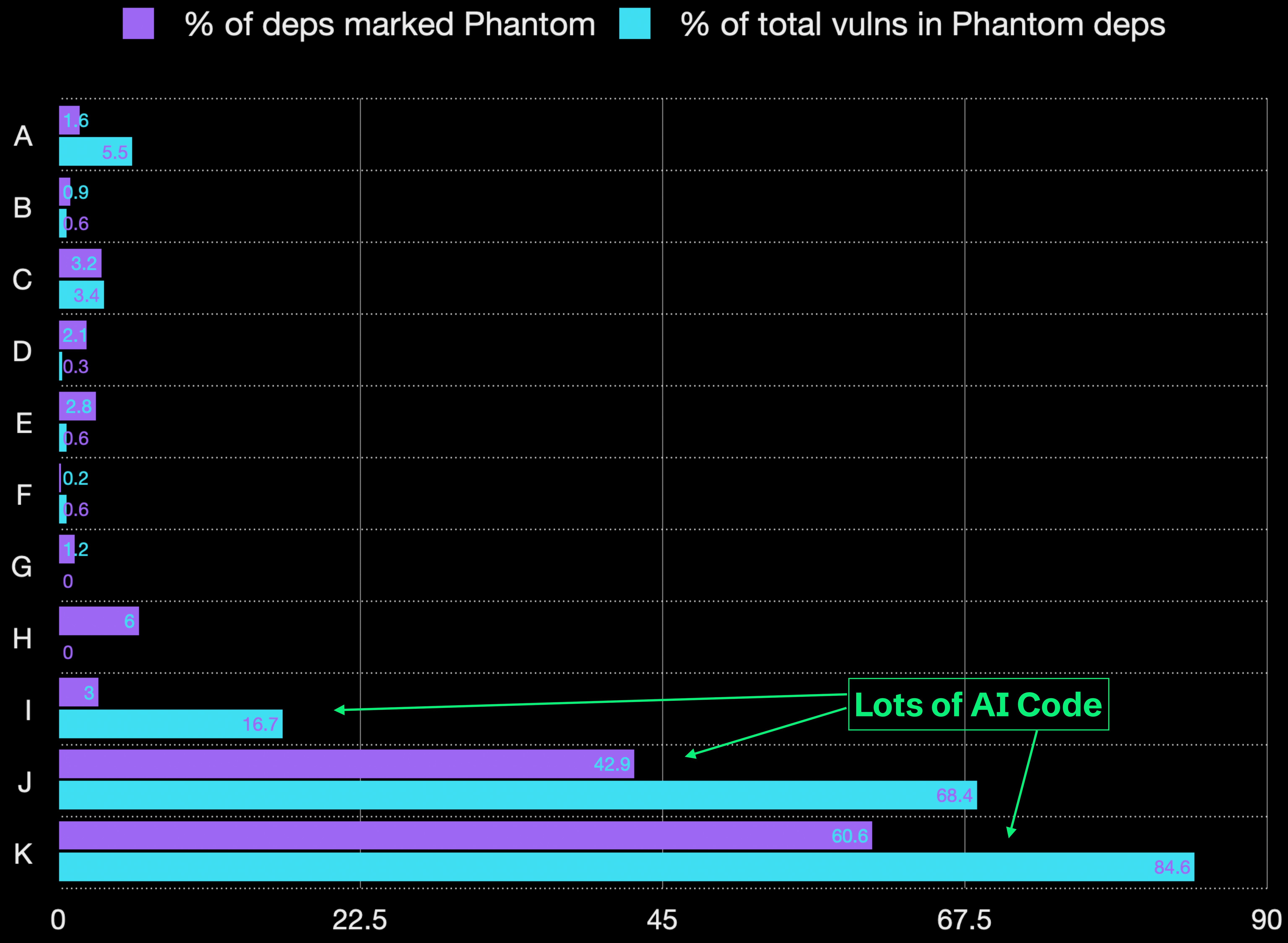
You can then try the following example code

```
from transformers import AutoModelForCausalLM, AutoTokenizer
import transformers
import torch

model_id = "amazon/MistralLite"
```

The Phantom Dependency Menace

- Dependencies that are either “provided” by the system are assumed to be downloaded manually
- Scripts, containers, and so on
- Often depend on the target platform
- Dependencies that are required for building an application that are not supposed to be used at runtime but are actually used
- Very common in NPM: see storybook for example



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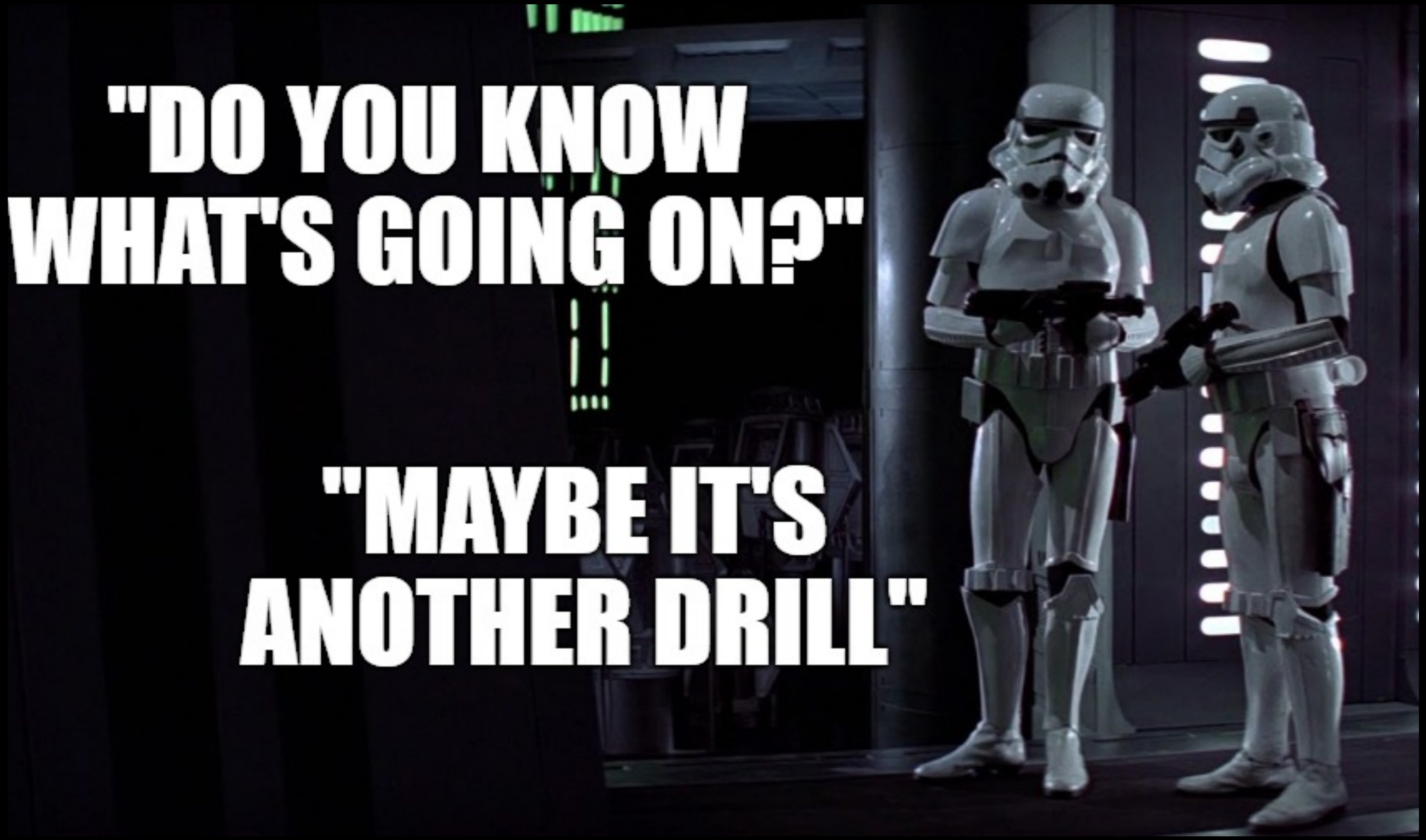
Security Challenges

- False sense of security — tools can't see what's not in a manifest, so you miss risks that might be relevant
- Inaccurate compliance data — your SBOMs aren't reporting everything in use. Auditors are unhappy if they catch you
- Dev / prod differences — can't rely on the version I see in dev pipelines being the same thing that's in production

Why are tools blind?



Many tools trust the manifest or lock files, and don't account for the ways those can lie

1. Phantom Dependencies (false negatives)
   - Brought by the system, runtime or other scripts
2. Mis-used dependencies (false negatives)
   - Dependencies brought as "test/dev" used in runtime
3. Direct use of transitives (unreliable fixing)
   - Dependencies brought in as transitives and used directly without knowledge
4. Unused dependencies (false positives and noise)
   - Dependencies brought in the manifest but not used by the code

Program Analysis FTW

What matters is which packages the code actually uses

1. Source of truth is actually the source code
   a. Analyze the code
   b. Create an Abstract Syntax Tree
   c. Analyze types and call flows
   d. Create a call graph

2. Correlate the dependencies used by the code with the dependencies fetch by the package manager or available in the file system

3. Create a unified view

Example: Python

Use the source

1. Import dependency ▶ Call graph ▶ "Is it used?"
    a. Repeat for all it's dependencies (transitive)

2. Compare dependency graph with versions installed on system and defined in manifest

3. Correlate and unify results
    a. Makes accurate SBOM and VEX possible

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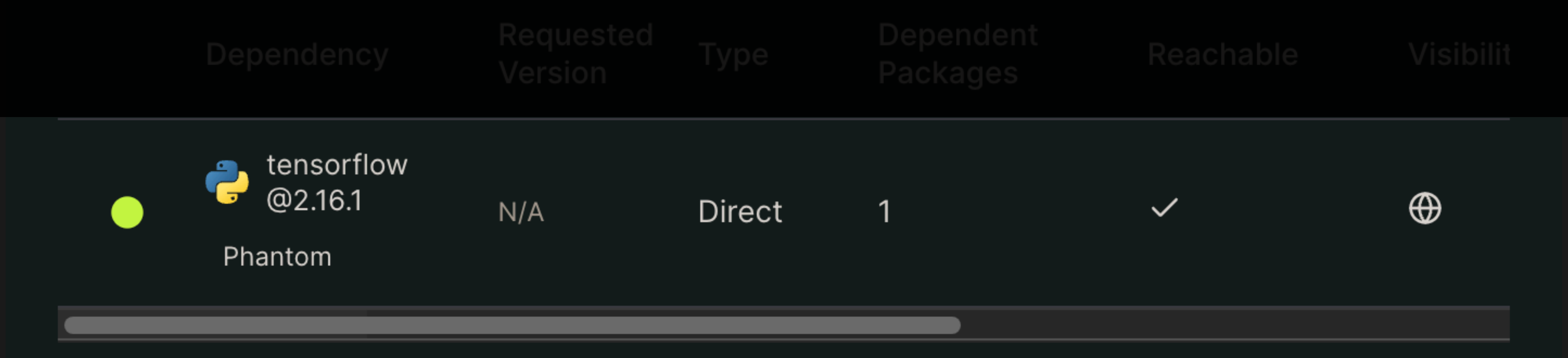
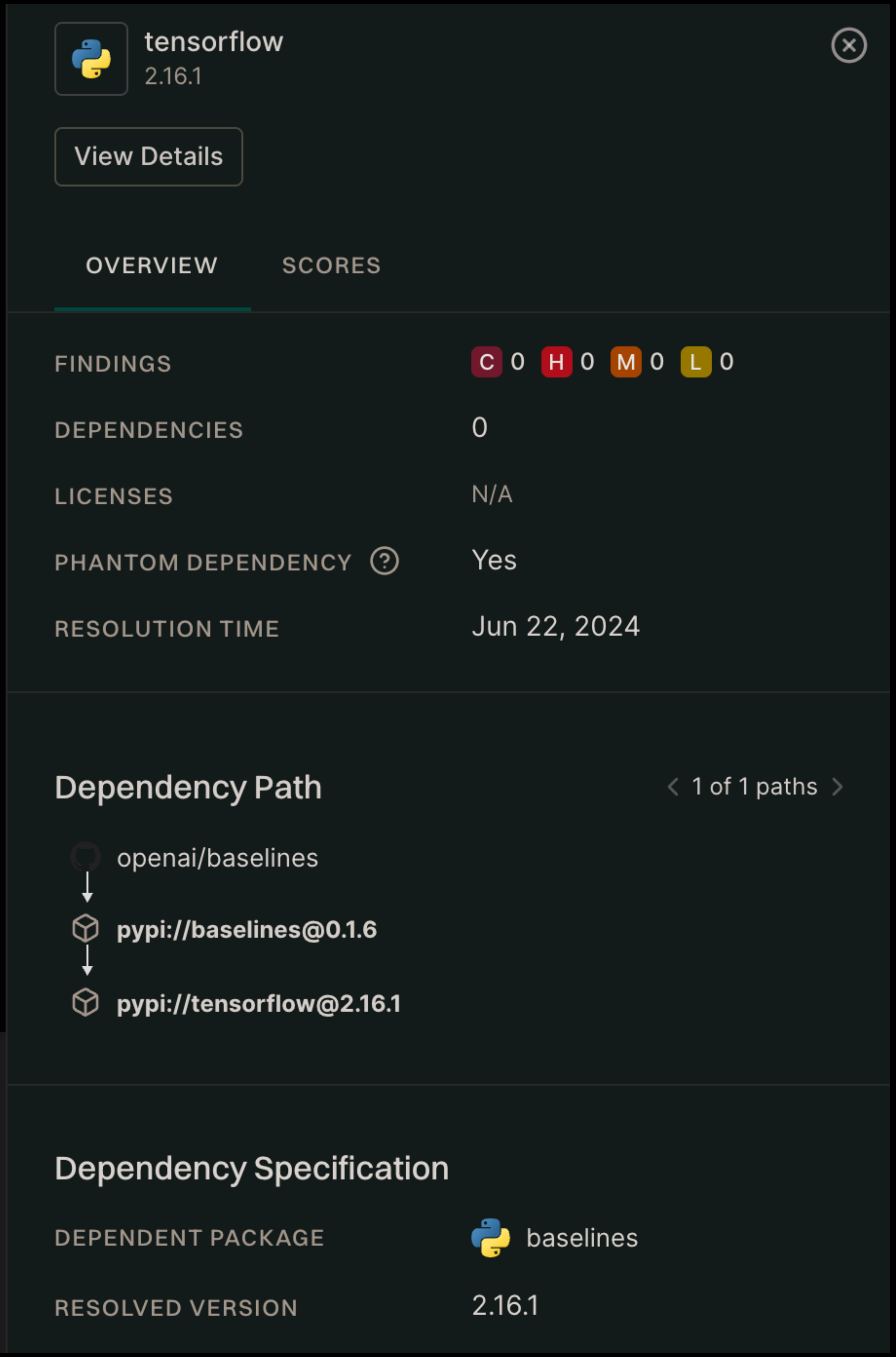
The Shameless Pitch

- Accurately identify all dependencies in use, even if they're "phantom"
- Provide clear mapping and pathway data
  - What uses it?
  - Directly vs. Transitively?
- Find out when transitive deps are being directly used
- Avoid the noise to devs by knowing whether a risk is actually along a call path





Greetz and Thanks

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Many, many more…