developer insights: machine learn and analytics on src/

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How to choose the dependency that fits the developer's need?

Things get faster, maybe more regulated

Things get critical, and more complex

How to stay up to date?

- Research more framework alternatives
- Test with different versions of your framework
- Analyse more build logs/failures
- What else… ?

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More research => less coding?!

Ask others...

- to do the mundane work
- Identify patterns and drawbacks
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Cyborgs to the rescue?!

Project Thoth

Create a knowledge graph that can be used by cyborgs to give some good advice to developers

https://thoth-station.ninja/
https://github.com/thoth-station/

goals

The AI Center of Excellence's Project Thoth has three strategic objectives

- Deliver optimized AI stacks as container images to demonstrate the concept
- Prototype AI-backed guidance to delivering value add information on application stacks
- Advanced Analytics and AI-backed automation CI/CD and software maintenance

goals

Increase developer velocity

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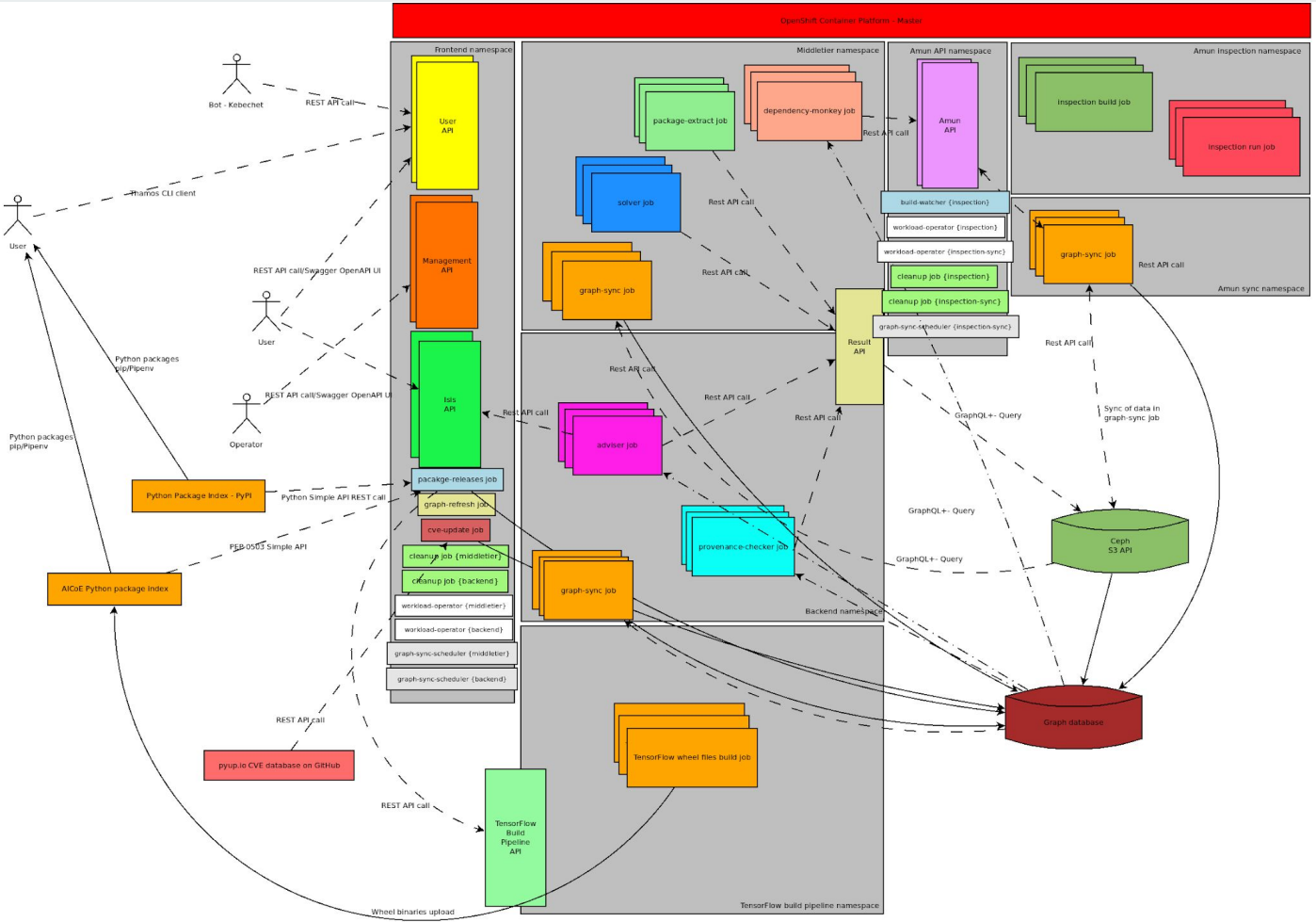
Arch overview



what we observe and store in our knowledge graph

Application Stack related:

- Buildtime and runtime environment
- Dependencies
- Performances

Software Package:

- Application Binary Interfaces (ABI)
- CVE

Source Code Meta Information:

- Project features (TTR, TTCI, etc,..) from different software development platform (Github, GitLab, Pagure, etc…)

what we observe and store in our knowledge graph

Application Stack related:

- Buildtime and runtime environment
- Dependencies

Thoth solver

Analyze each Python package version

- Get its dependencies by installing it
- Aggregate information about possible installation errors
  - Analysis of installation logs
  - Package was not installed due to

what we observe and store in our knowledge graph

Application Stack related:

- Performances

Thoth Dependency Monkey and Amun

- Creates combination of software stacks and create inputs for Amun
- Run Performance Indicator to gather performance observations:
  - ML frameworks
  - Python Interpreter

what we observe and store in our knowledge graph

Package-extract

- Extract dependencies from an image and image build logs

Software Package:

- Application Binary Interfaces (ABI)
- CVE

CVE Update job

- checks for new CVE records in the safety-db provided by PyUp.io.
- store them in the database

what we observe and store in our knowledge graph

Src Ops Metrics

- Gather information from software development platforms:
  - GitHub
  - GitLab
  - Pagure

Source Code Meta Information:

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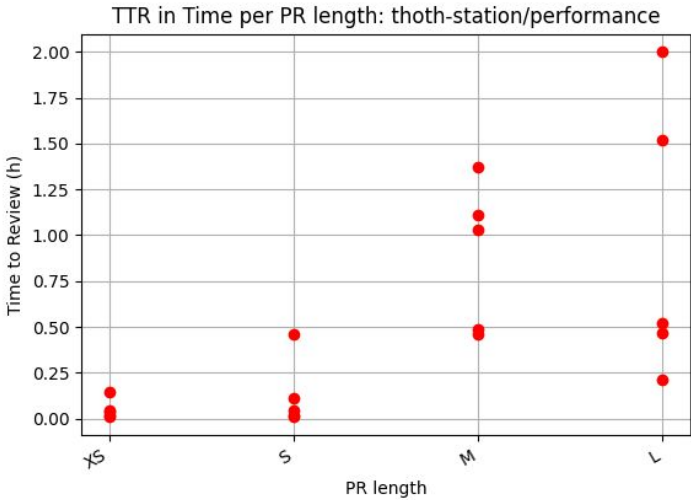
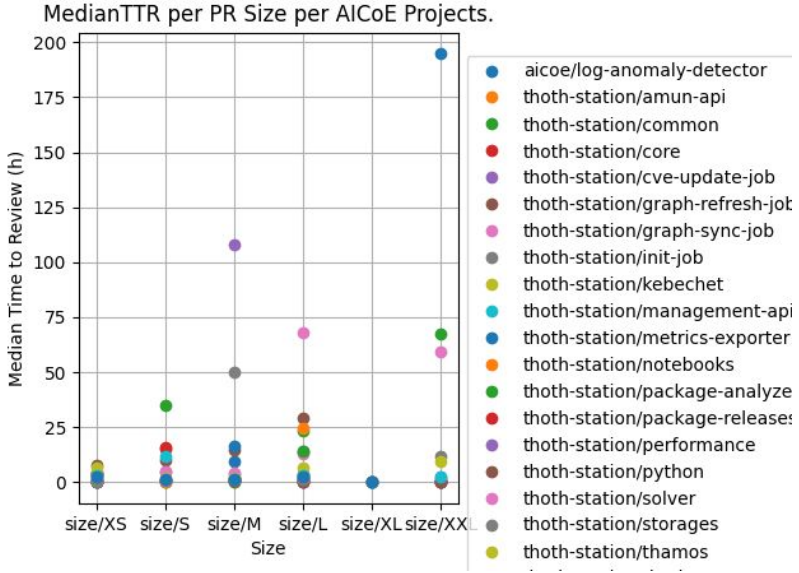
what we observe and store in our knowledge graph





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How to choose the dependency that fits the developer's needs?

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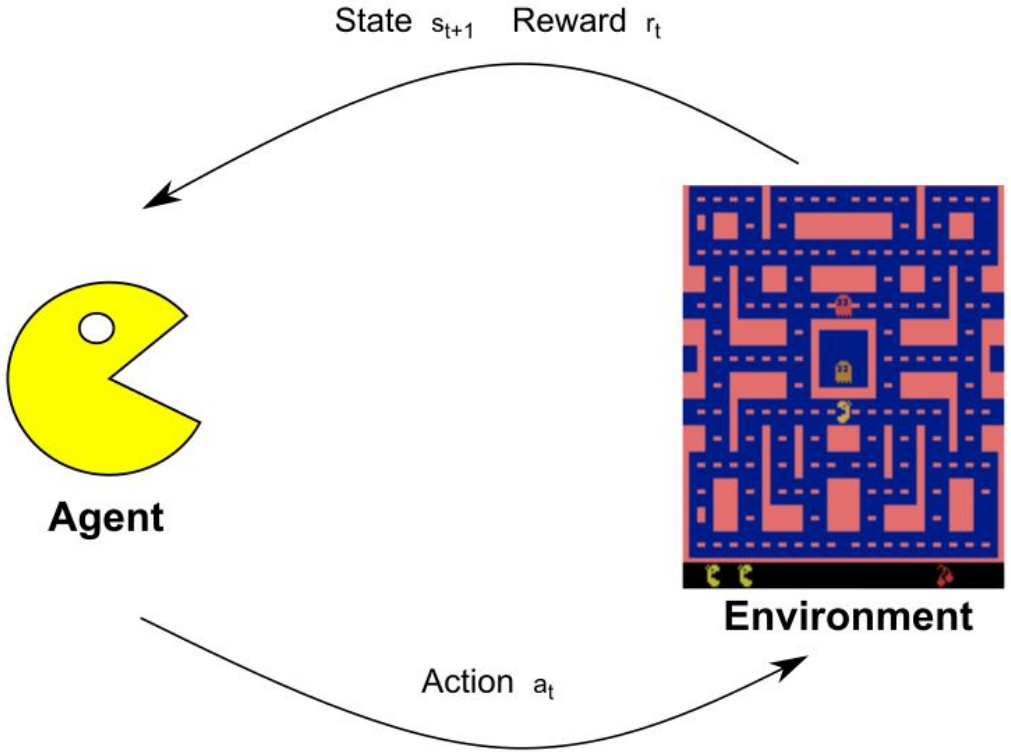
Let the machine decide how to satisfy developer's needs!

ML in Thoth

- Recommender system is called **Adviser** in Thoth.
- It uses Reinforcement Learning (RL).

RL in general



ML in Thoth - RL

- **Agent:** resolver
- **Environment:** package dependencies
- **State**: resolver state
- **Actions**: set of actions given by the predictor
- **Policy**: maximize the cumulative reward (long-term)

ML in Thoth - Resolver

- Respect the ecosystem
- Works offline because all dependencies are collected in the database already
- Resolve software stacks using new type of observations;
- Resolution is considered as Markov Decision Process (MDP);
- Resolver uses pipelines Steps and Sieves to compute Rewards and Filter out packages;
- It is tightly coupled with Predictor;

ML in Thoth - Predictor

- Guide resolver in the expansion of state, until a finite state is reached :
    - Expand states that are the most promising ones to be used by users - used for recommending software stacks in adviser
    - Expand states for which Thoth has no observation about - used for filling Thoth's knowledge base using Dependency Monkey and Amun
- It’s trained using observations gathered
- Temporal Difference (TD), Monte Carlo Tree Search

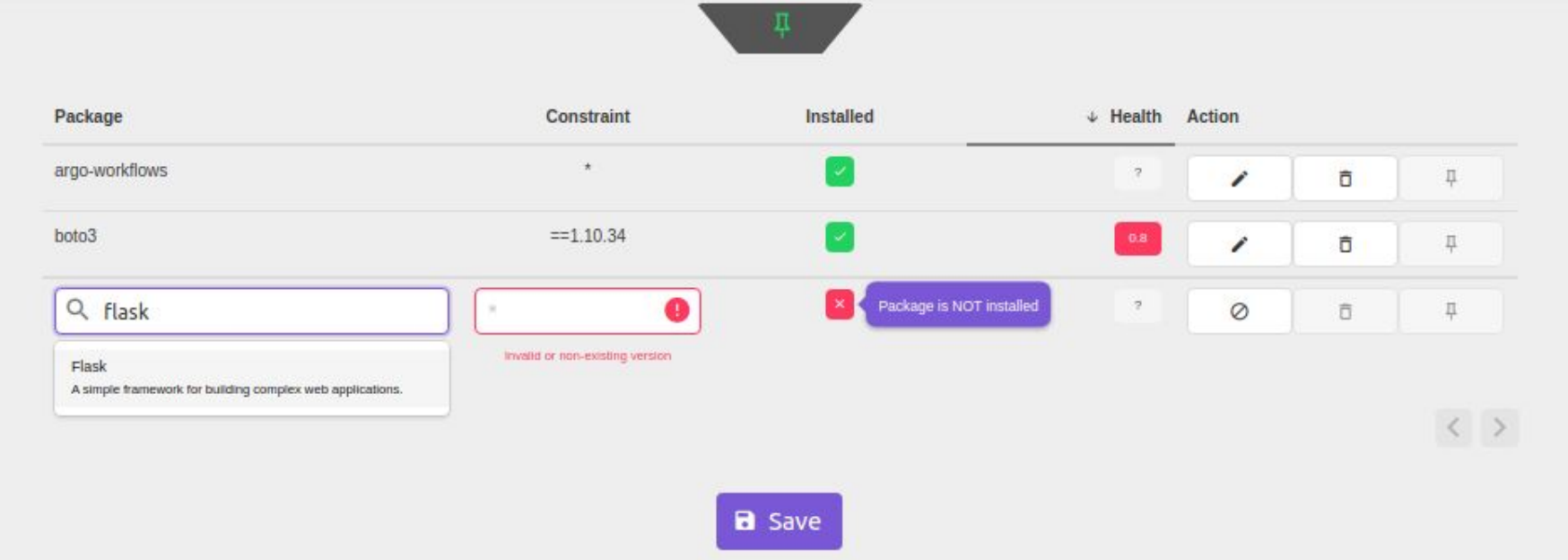
How we help Devs

- Keep dependencies up to date.
- Maintain software stack secure avoiding CVE.
- Recommend the most performant software stacks for AI Apps.
- Integrate source metadata information related to the packages used in the software stack to give advice to users.
- Integrate Thoth in day-to-day developers/data scientists tools.

cmd, OCP, GitHub, Notebook integration

- Command line tool thamos (developer laptop)
- Cyborg Kebechet (pull request creator)
- Source-to-Image (container builder)
- Jupyter Notebooks (data scientist browser)
- GitHub App Qeb-Hwt (CI pipeline check)

Example: nb-requirements



Call to action, participate

- `Pipenv install thamos ; thamos advise`
- Create PR fixing #hacktoberfest
- Let us know what kind of observation you made/want

references

- Website:
  - https://thoth-station.ninja/

- Twitter
  - https://twitter.com/thothstation

- GitHub
  - https://github.com/thoth-station

Thank you

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