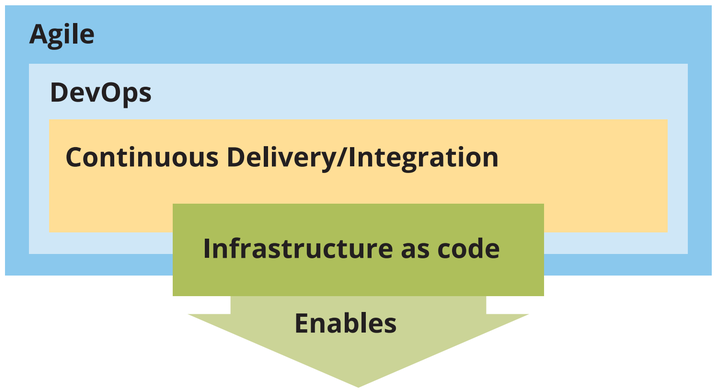
Infrastructure as Code

Feasibility of recovery of software deployment architecture

DoD sustainment organizations want to adopt agile practices and realize the benefits of DevOps and infrastructure as code (IaC). They must first recover the technical baseline for the software deployment. This project has prototyped technology to automatically recover the deployment baseline and create the needed IaC artifacts, with minimal manual intervention and no specialized knowledge about the design of the deployed system.

IaC is the process and technology to manage and provision computers and networks (physical or virtual) through scripts. IaC is a foundation of integrated development and operations (DevOps) that provides automated deployment to the integration environment and repeatability through immutable infrastructure, enables exploration and experimentation by providing environment versioning and rollback, and ensures parity of test and integration environments across locations and organizations. IaC is usually associated with Agile and DevOps, but it can provide benefits outside of Agile.



Today

- Automated deployment
- Immutable infrastructure
- Versioning and rollback
- Environment parity

Future

- Portability across IaaS
- Assurance evidence
- Moving target defense

Our approach has four elements. We **crawl** through an instance of the deployed system and inspect each node to create an inventory of software. Next, we **analyze** the inventory and "make sense of it" — identify which software is part of the operating system, which other packages are installed, and which is the application software. From this analysis, we populate a **deployment model** of the system. From the deployment model, we **generate** the scripts needed by the infrastructure as code tools, which execute the scripts to create a new deployment of the system

Crawl: Our crawler uses a novel approach to execute a script written in the Python programming language on the source system without installing additional software.

Analyze: We first determine the source repository for each installed package and associate files to installed packages. We then run a set of heuristic rules that uses file patterns to identify configuration files and pattern matching within configuration files to identify directories and files added to the system outside of installed packages.

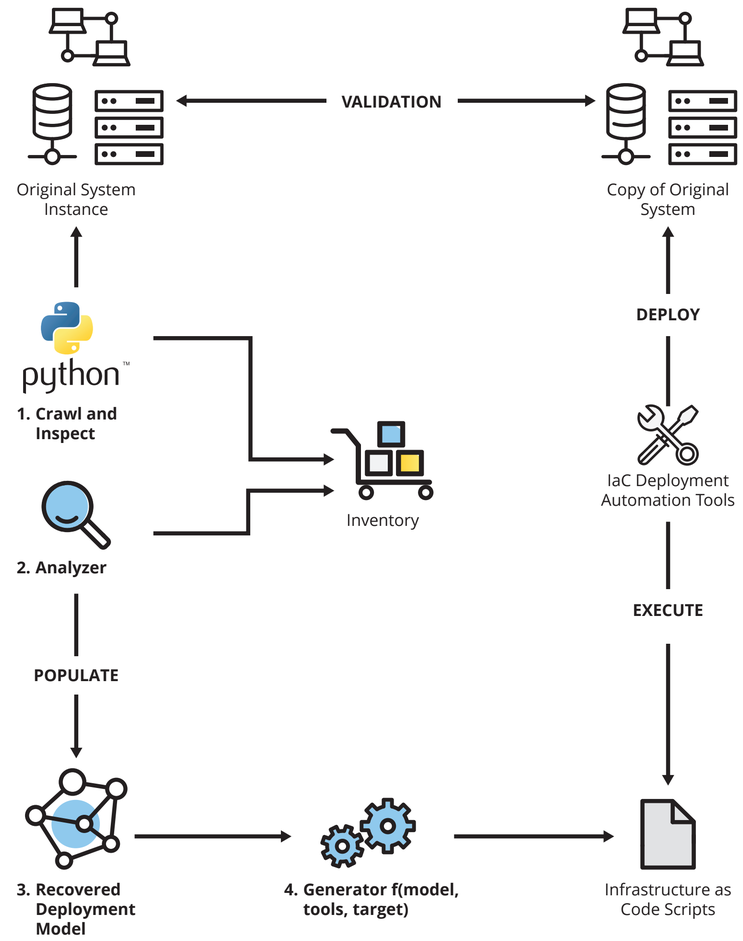
Heuristics classify files by source. The heuristic rules infer identity and source of files that are not installed with a package, such as:

- Content served up by an installed web server
- Scripts or services delivered from an installed web container like nginx or Apache Tomcat
- Configuration and schema definition files for an installed database
- Standalone user services or applications

The **deployment model** is a relational schema that represents all of the facts and inferences.

Generate: Our prototype generates a set of scripts for the open source Ansible automation tool. The prototype can be extended to generate scripts for other tools.

Approach: Crawl, analyze, populate a model, and generate IaC artifacts.



Limitations and future work: Our approach is limited to Linux-based systems. We have demonstrated an initial set of heuristics rules covering a number of inference types and patterns, with extensibility to add new rules to broaden coverage.

Software sustainment organizations can use this tool to quickly understand a system, and create and run automated deployment scripts to enable exploration and evolution.

Dr. John Klein | jklein@sei.cmu.edu