Orchestrating applications with TOSCA and Docker

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A.Y. 2015/2016

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Context: Managing composite cloud applications

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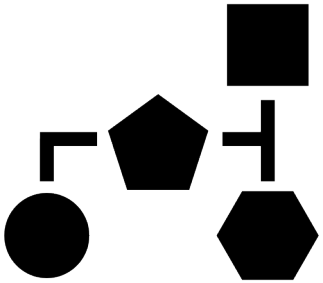

Application specification

Context: Managing composite cloud applications

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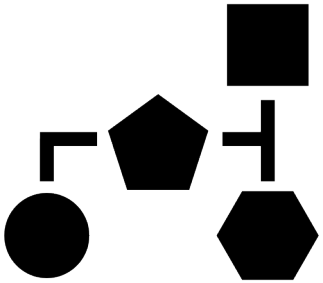

Application specification

Application orchestration

Two orthogonal approaches

OASIS TOSCA

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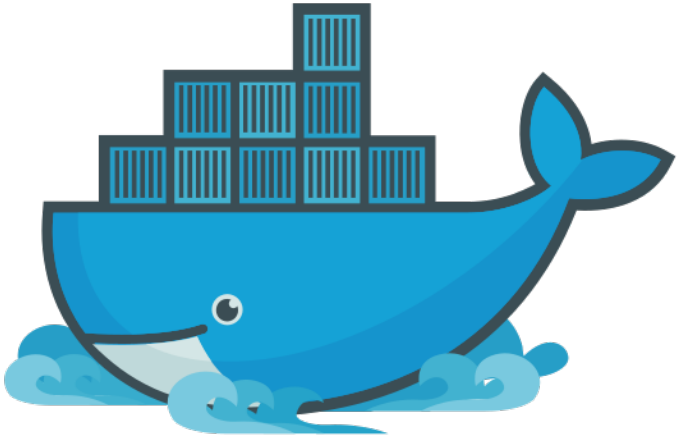

Docker

Pro and cons of TOSCA and Docker

TOSCA

+ Well-documented standard
+ Application orchestration

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– Lack of engines

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+ Production ready tool
+ Repository of images

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Docker

+ Production ready tool
+ Repository of images

– Application orchestration
– “Only containers”

Objective

The objective of this thesis was to identify and develop a solution that takes the best of TOSCA and Docker.

Main objective

Design and prototype an orchestration engine capable of deploying multi-components applications.

- It inputs applications specified in TOSCA YAML
- It automatically manages applications by exploiting Docker

State of the art

TOSCA orchestrator

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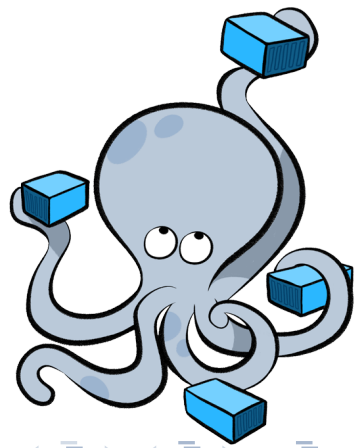
TOSCA orchestrator

Docker orchestrator



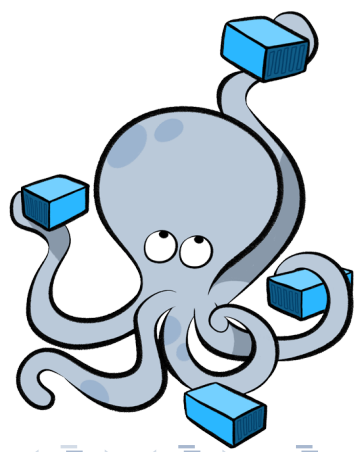
State of the art

TOSCA orchestrator

apache brooklyn

Docker orchestrator

kubernetes



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Describing applications in TosKer

- Applications are specified as a composition of the following components:
  - *Docker containers* `tosker.nodes.Container`, `tosker.nodes.Container.Executable`
  - *Docker volumes* `tosker.nodes.Volume`
  - *Software* `tosker.nodes.Software`

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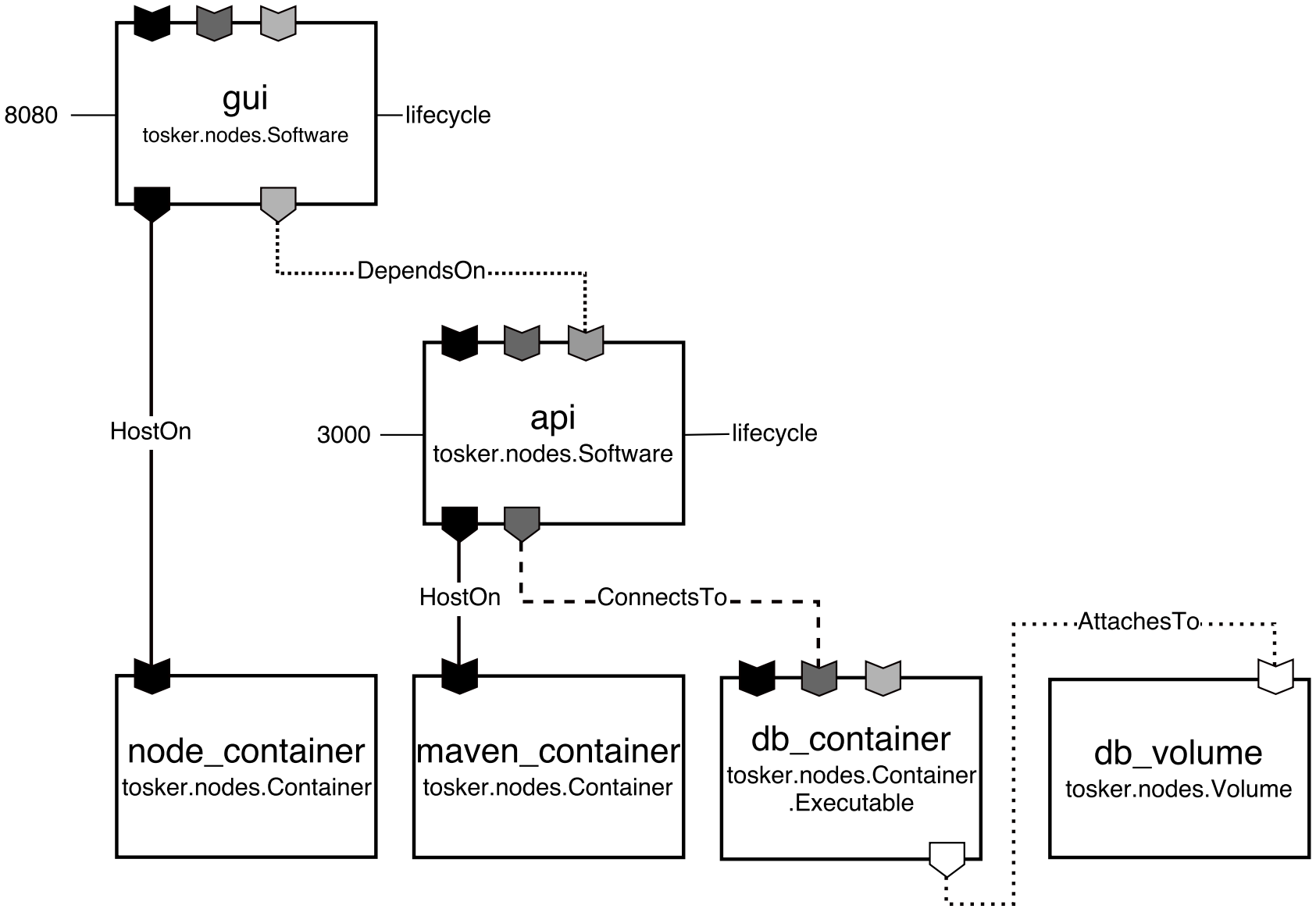
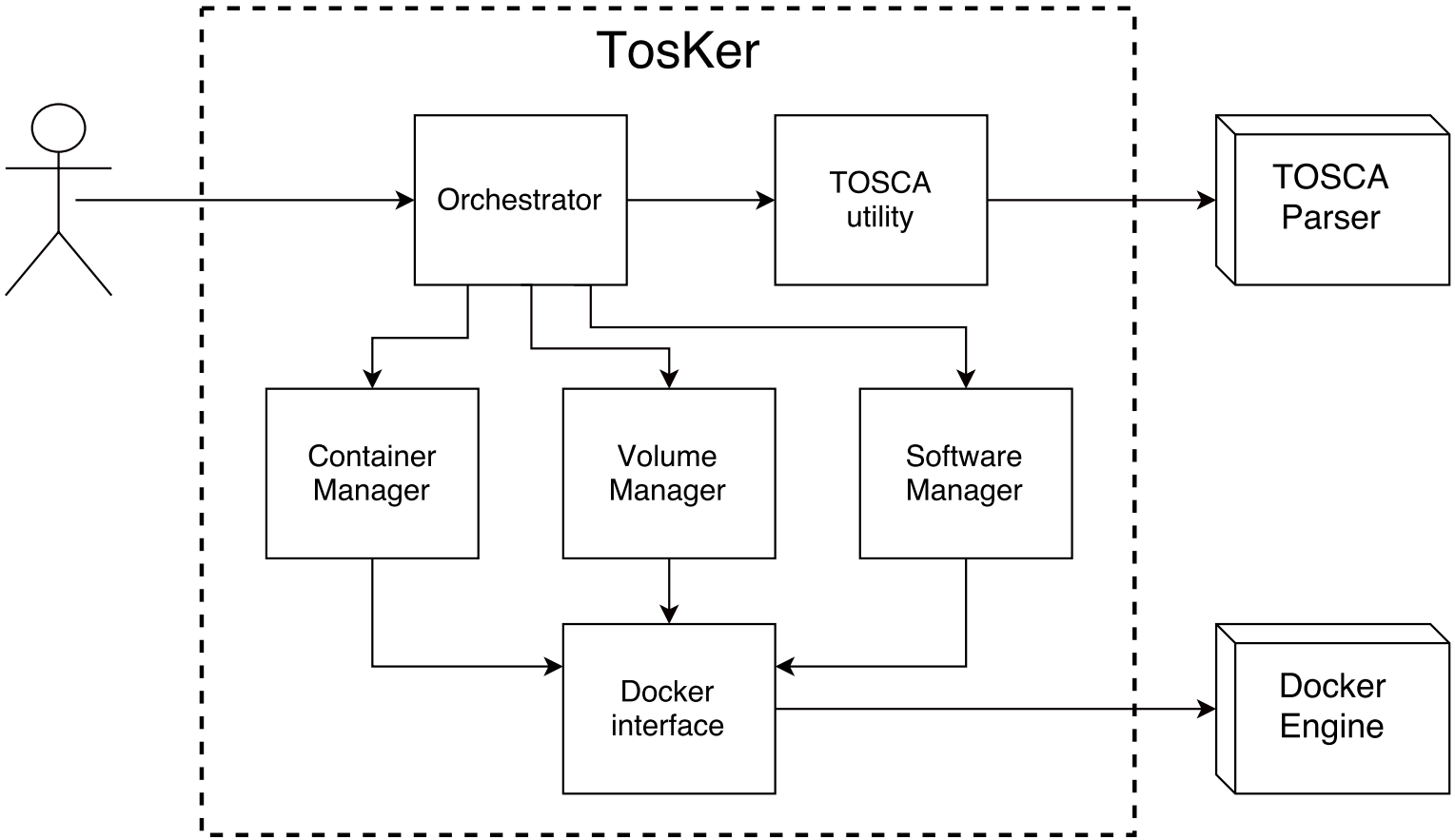
  - *Docker volumes* `tosker.nodes.Volume`
  - *Software* `tosker.nodes.Software`
- There can be the following relationships between components:
  - *hosted on* `tosca.relationships.HostedOn`
  - *connected to* `tosca.relationships.ConnectsTo`
  - *attached to* `tosca.relationships.AttachesTo`
  - *depending on* `tosca.relationships.DependsOn`

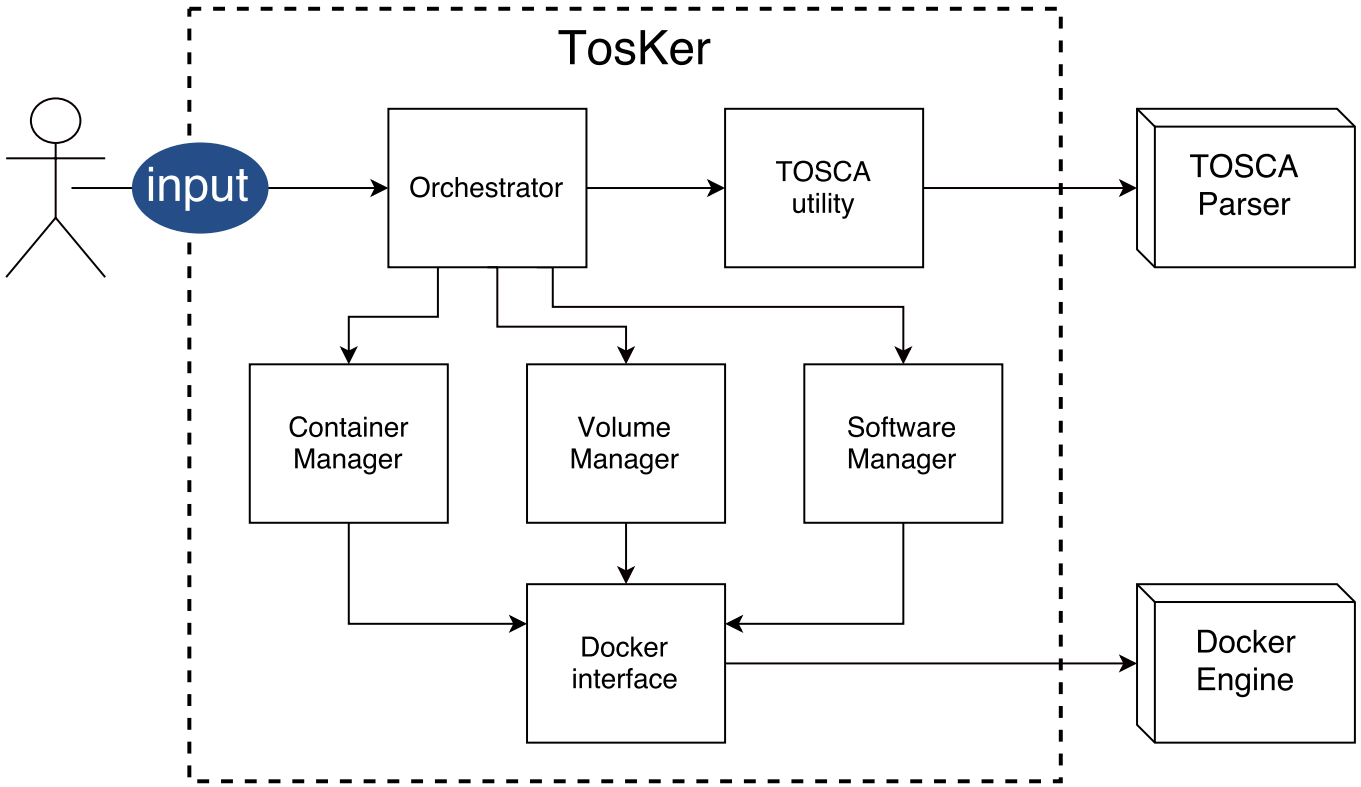
Use case


gui
tosker.nodes.Software
8080
lifecycle
DependsOn
HostOn
api
tosker.nodes.Software
3000
lifecycle
HostOn
ConnectsTo
AttachesTo
node_container
tosker.nodes.Container
maven_container
tosker.nodes.Container
db_container
tosker.nodes.Container
.Executable
db_volume
tosker.nodes.Volume

Architecture of TosKer



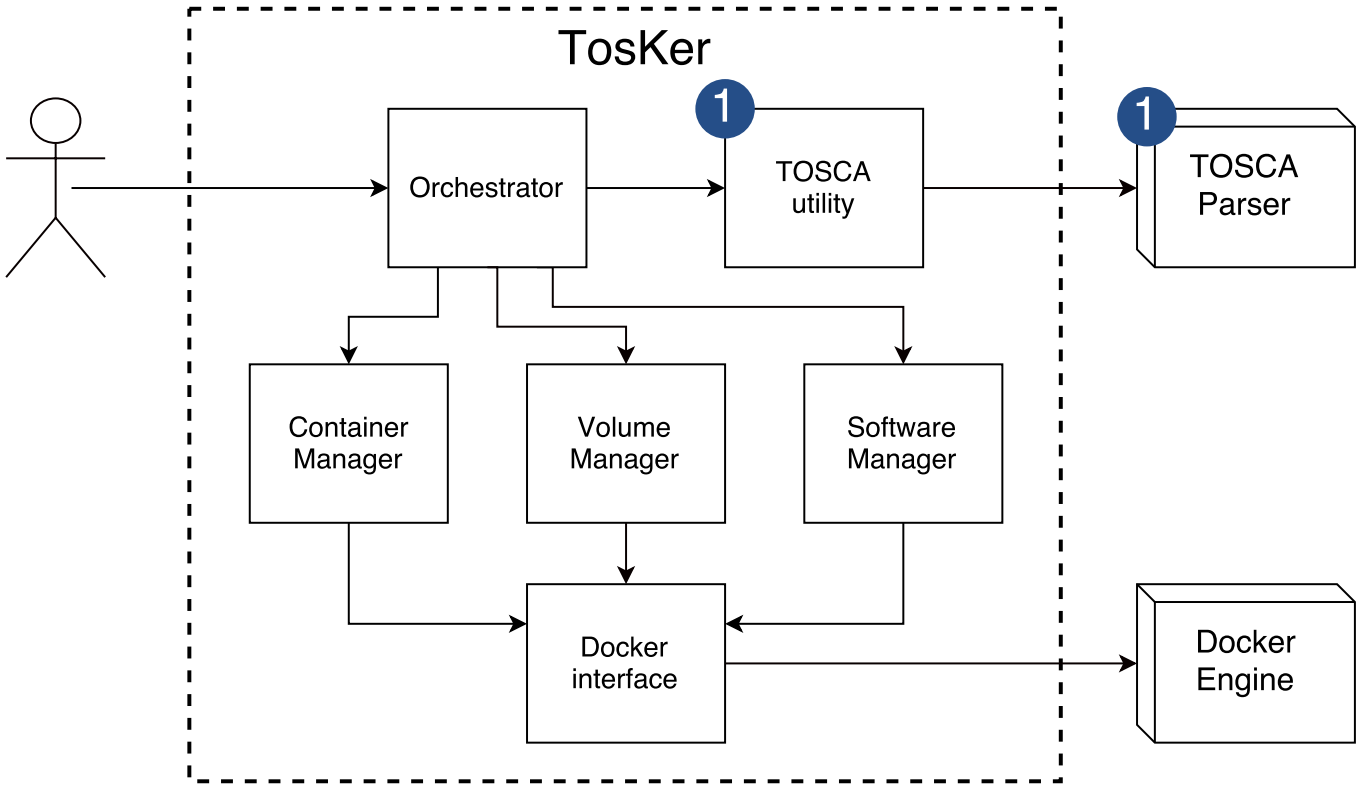
How TosKer orchestrates applications



The input of TosKer is

- a TOSCA application specified using TosKer types, and
- management operation(s) to perform.

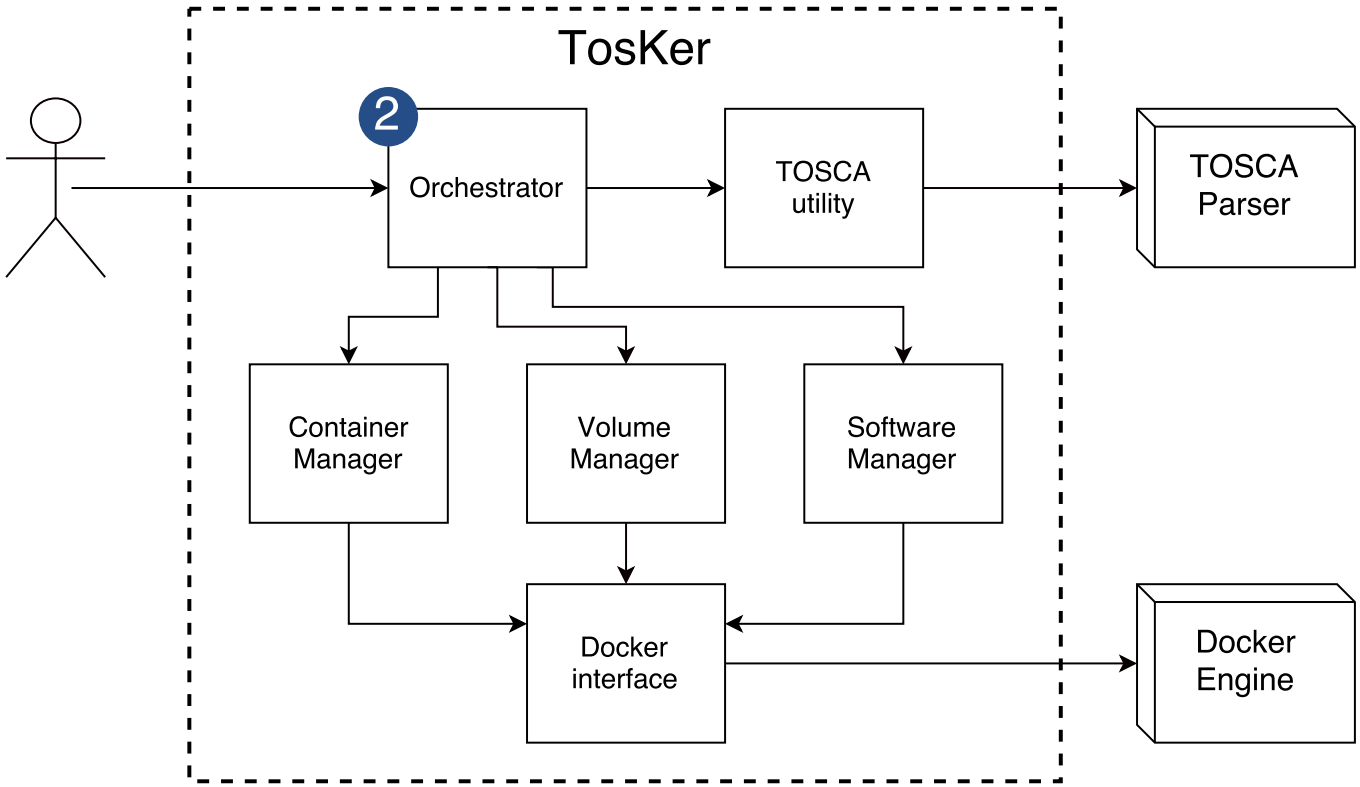
How TosKer orchestrates applications



TosKer

- parses and validates the TOSCA application, and
- executes a topological sorting algorithm.

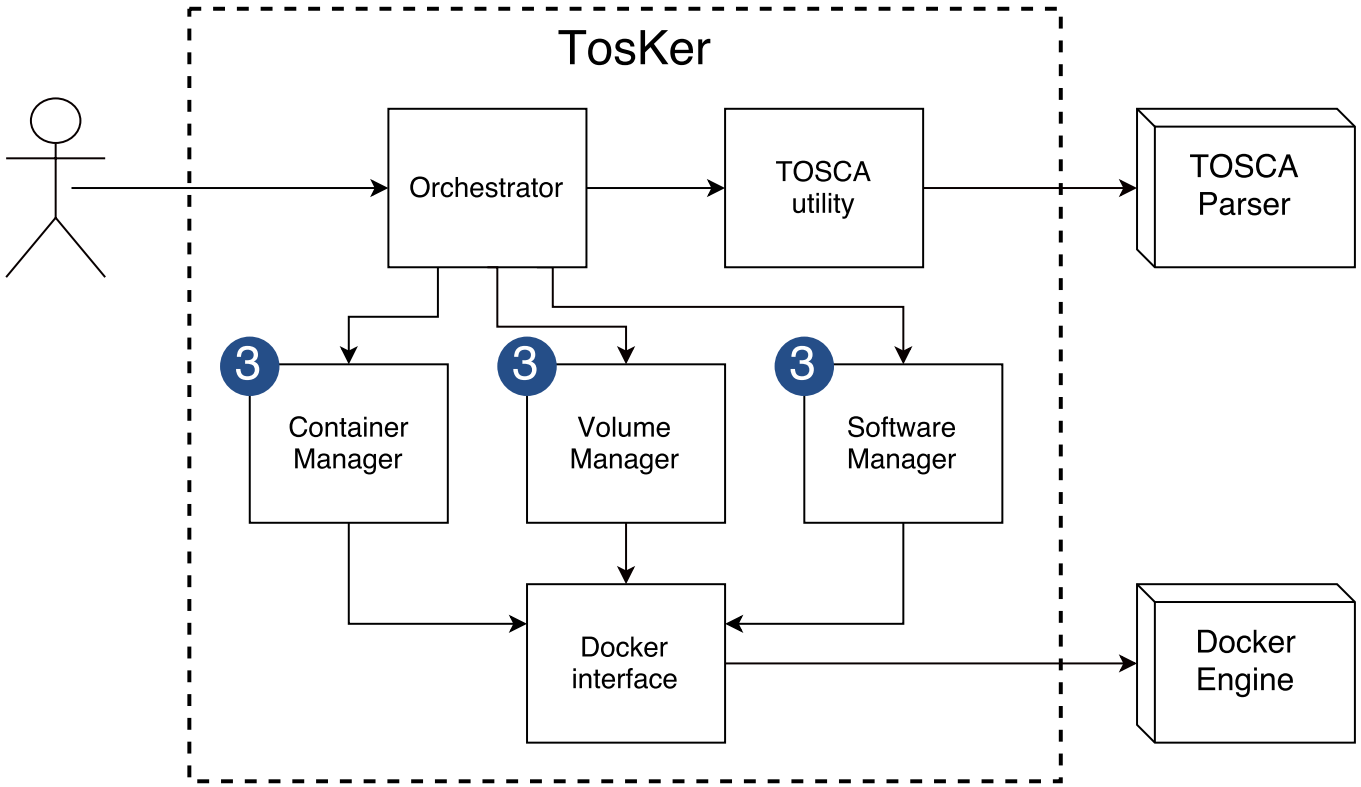
How TosKer orchestrates applications



TosKer

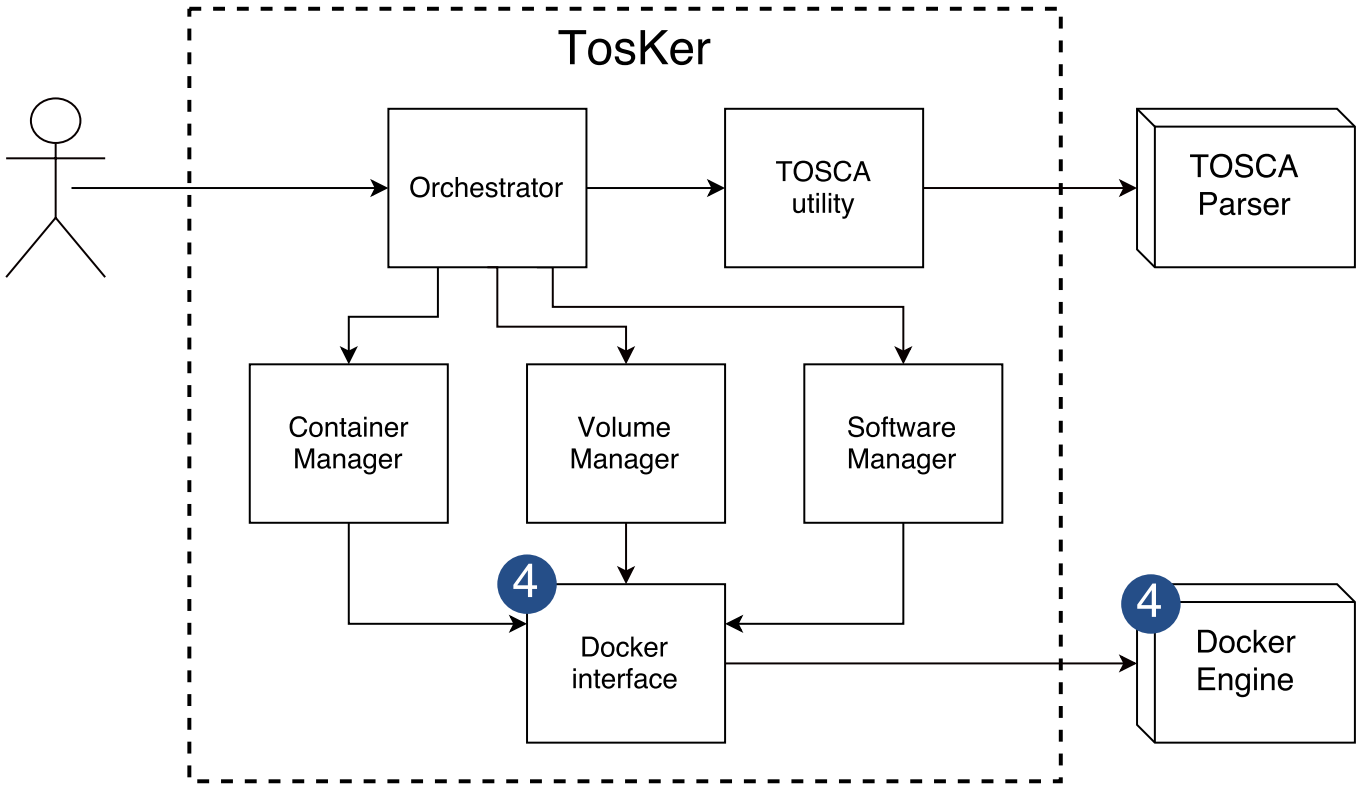
- scans the sorted application topology, and
- for each component, it calls a specific operation (e.g., create)

How TosKer orchestrates applications



Each manager is in charge of implementing/executing the invoked operation on a component...

How TosKer orchestrates applications



...by properly invoking the Docker engine (through the Docker interface)

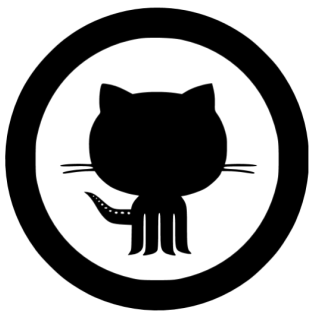
Implementation of TosKer

Python

- **PyPI**: https://pypi.python.org/pypi/tosKer
  `pip install tosker`

Implementation of TosKer

Python



GitHub

MIT Licence

- **PyPI**: https://pypi.python.org/pypi/tosKer
  `pip install tosker`
- **GitHub**: https://github.com/di-unipi-socc/tosKer

Usage of TosKer command-line

```
tosker FILE COMMANDS... [OPTIONS] [INPUTS]
tosker -h|--help
tosker -v|--version

FILE: TOSCA YAML file or CSAR file

COMMANDS:
  create    Create application components
  start     Start applications components
  stop      Stop application components
  delete    Delete application components (except volumes)

OPTIONS:
  -h --help       Print usage
  -v --version    Print version
  -q --quiet      Enable quiet mode
  --debug         Enable debugging mode (override quiet mode)

INPUTS: provide TOSCA inputs (syntax: --NAME VALUE)
```

VIDEO-DEMO

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Conclusions and future work

We have presented TosKer, an orchestration engine, which

- extends TOSCA by providing a Docker-based orchestration engine for TOSCA application, and
- extends Docker by adding the capability of orchestrating software components together with Docker containers/volumes

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- Support cluster of workstations and external cloud services

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- Automatically determine the Docker containers needed to effectively run an application

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Future work

- Support cluster of workstations and external cloud services
- Automatically determine the Docker containers needed to effectively run an application
- Integrate TosKer with fault-aware management protocols

Thank You

Q&A