DICE Fault Injection Tool

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DICE

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Overview

- Motivation
- Fault Injection Tool
- DICE project and DevOps
- Conclusion

Motivation

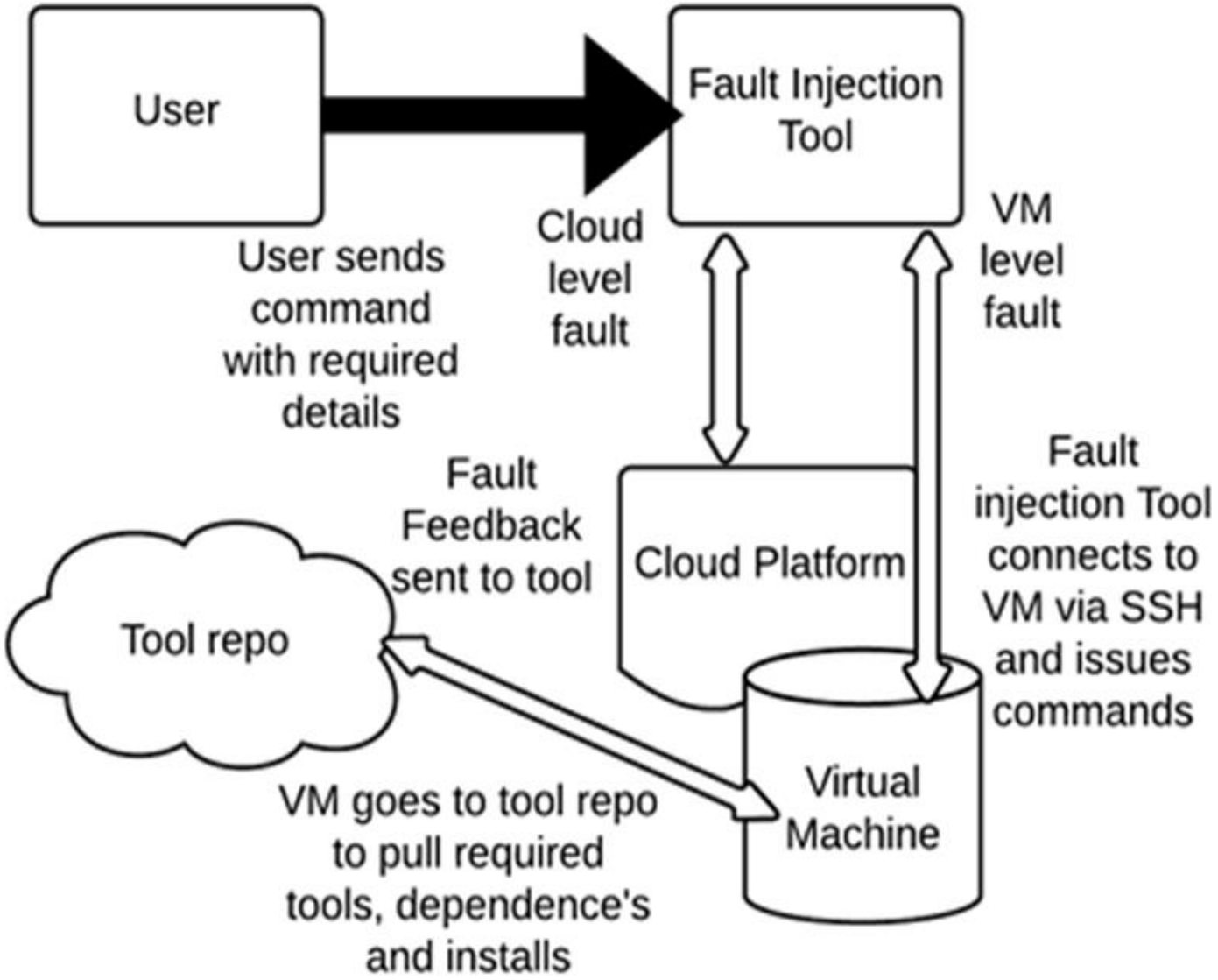
- Infrastructure equipment fails
- Expensive approach:
  - Making hardware completely reliable
  - Making sure that software never fails
- Reasonable approach:
  - Make systems resilient to failures
- Need for on-demand failures

Fault Injection Tool

Fault Injection Tool

- Problem
  - When testing, it is difficult to **reproduce faults** happening in production
- Goal
  - Causes environmental problems or **failures on demand**
  - Lets users **control** the **levels** and seriousness of induced failures

Design


User
Fault Injection Tool
User sends command with required details
Cloud level fault
VM level fault
Fault Feedback sent to tool
Cloud Platform
Fault injection Tool connects to VM via SSH and issues commands
Tool repo
Virtual Machine
VM goes to tool repo to pull required tools, dependence's and installs

Supported VM-level Faults

- **Shutdown** random VM (black list or white list)
- High **CPU** for VM
- High **Memory** usage for VM
- Block VM external **network** access
- High **Network Bandwidth** usage
- High **Disk I/O** usage
- Stop a **service** running on VM

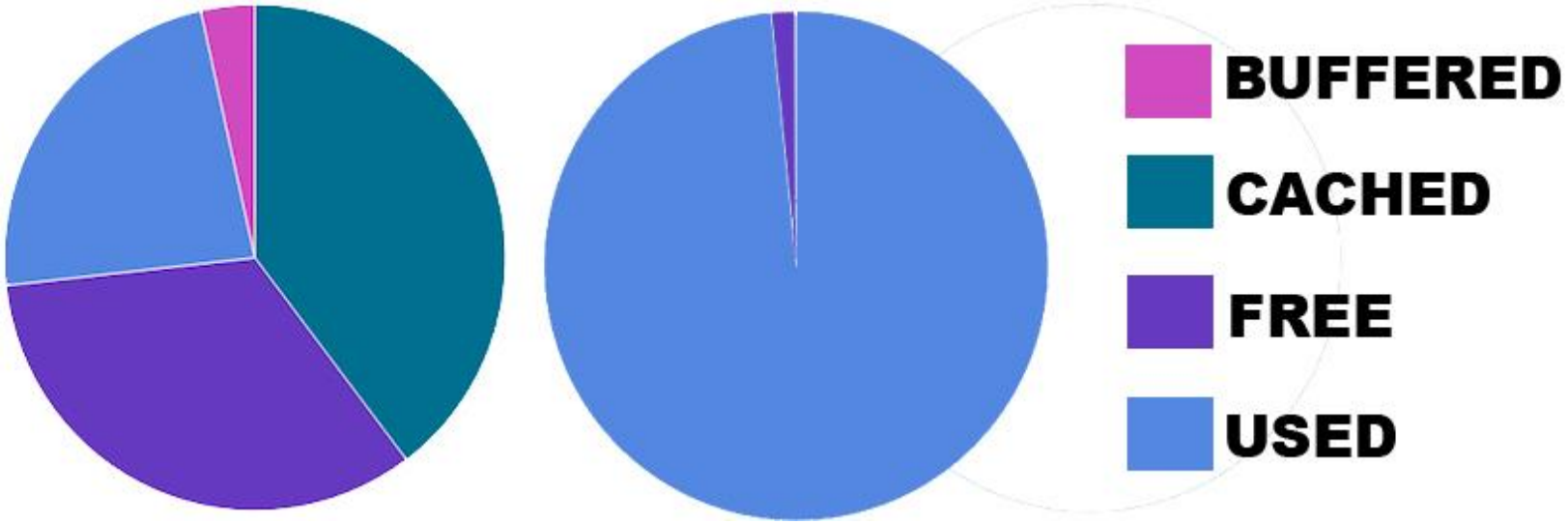
Supported Cloud-level Faults

- **Shutdown** a Node
- High **CPU** for Node
- High **Memory** usage for Node
- High **Bandwidth** usage

Usage example command

```
$ fleximonkey --stressmem \
    2 \                                  test loops
    2048m  \                             total memory
    ubuntu@109.231.126.101 \             ssh host
    -no \                                no password
    home/ubuntu/SSHKEYS/VMkey.key
```

Usage example result

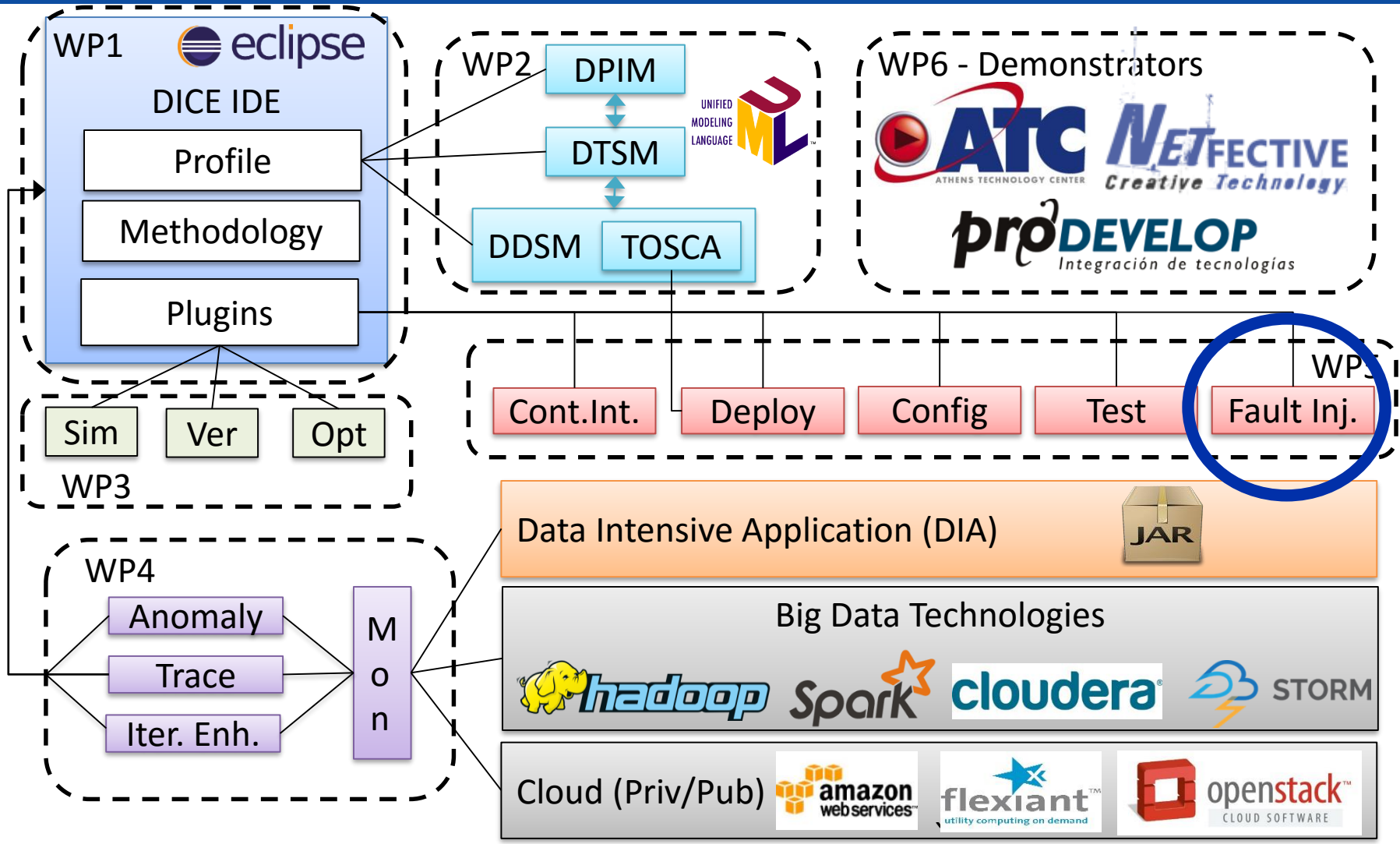


Innovation

- ChaosMonkey: only accesses AWS & terminates VMs.
- Cocoma: developed but not supported, suffers from high resource usage, complex config & limited extensibility.

- FIT generates various cloud agnostic faults at VM & Cloud.
- Range of functions, greater flexibility to generate multiple faults
- Lightweight and only installs required tools and components on target VMs.
- Future extensibility in mind considering the needs and challenges of cloud service providers such as scalability and resiliency of the cloud consumption marketplace.

DICE Framework



Use in DevOps

- Continuous Integration/Testing
  - Regular resilience tests
- Anomaly detection
  - Induce faults, check for anomalies
  - Help with quality enhancement

Conclusion and future work

- Aimed at **developers** using **quality driven DevOps** approach
- Helps **cloud operators** perform stress analysis
- Difficulties and possibilities of **extensibility** by external users and investigating limitations
- Consider different topologies, operating systems and vendor agnostic cloud provider infrastructure
- Evaluate the **overhead** of operation
- **Containerised environments** will be a future target to help understand effect on microservices when injecting faults to the underlying host

Release: February 2017

https://github.com/dice-project/DICE-Fault-Injection-Tool