(YET) ANOTHER ATTEMPT AT ONLINE FAILURE PREDICTION

EUBRA BIGSEA

EUROPE - BRAZIL COLLABORATION OF BIG DATA SCIENTIFIC RESEARCH THROUGH CLOUD-CENTRIC APPLICATIONS

ATMOSPHERE

Adaptive, Trustworthy, Manageable, Orchestrated, Secure Privacy-assuring Hybrid, Ecosystem for REsilient Cloud Computing

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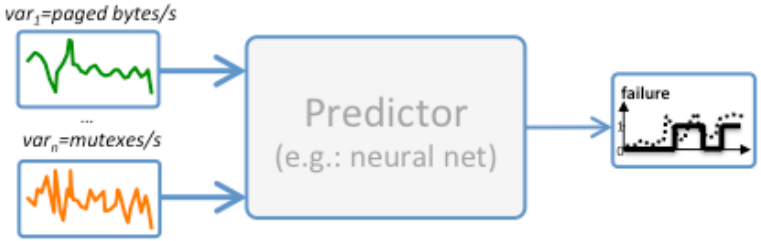
J. Lopes
N. Antunes

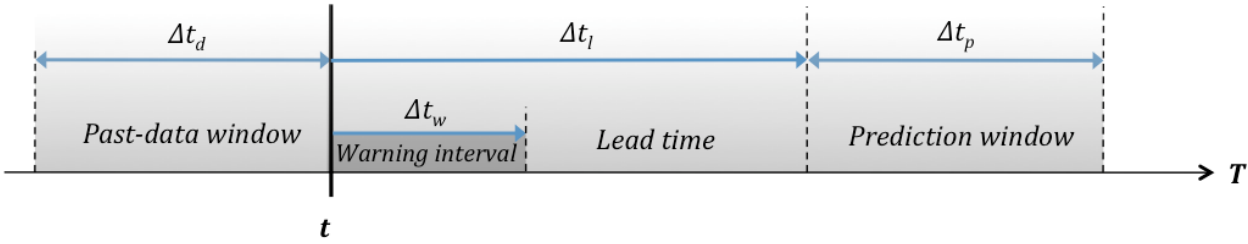
Nuno Antunes
nmsa@dei.uc.pt
Department of Informatics Engineering
University of Coimbra - Portugal

FAILURE PREDICTION

- Uses prediction models **trained** with data of **failure** events
  - Data can be numerical (e.g., free memory) or categorical (e.g., events)
  - Models can be built using machine learning, statistics, etc.



- Salfner & Malek's model:
  - Predictors trained using data from Δt_d
  - Prediction performed at time t for failures occurring in the interval $\Delta t_l \pm \Delta t_p$
    - Δt_w is the minimal time below which (even) a predicted failure cannot be avoided
  - Output: 0/1, failure probability



NOT A NEW CONCERN

HotDep

Fault Injection for Failure Prediction Methods Validation

HotDep 2009

Marco Vieira[1], Henrique Madeira[1], Ivano Irrera[1], Miroslaw Malek[2]

[1] *University of Coimbra – Portugal*
[2] *Humboldt-Universität zu Berlin – Germany*

mvieira@dei.uc.pt, henrique@dei.uc.pt, ivano@dei.uc.pt, malek@informatik.hu-berlin.de

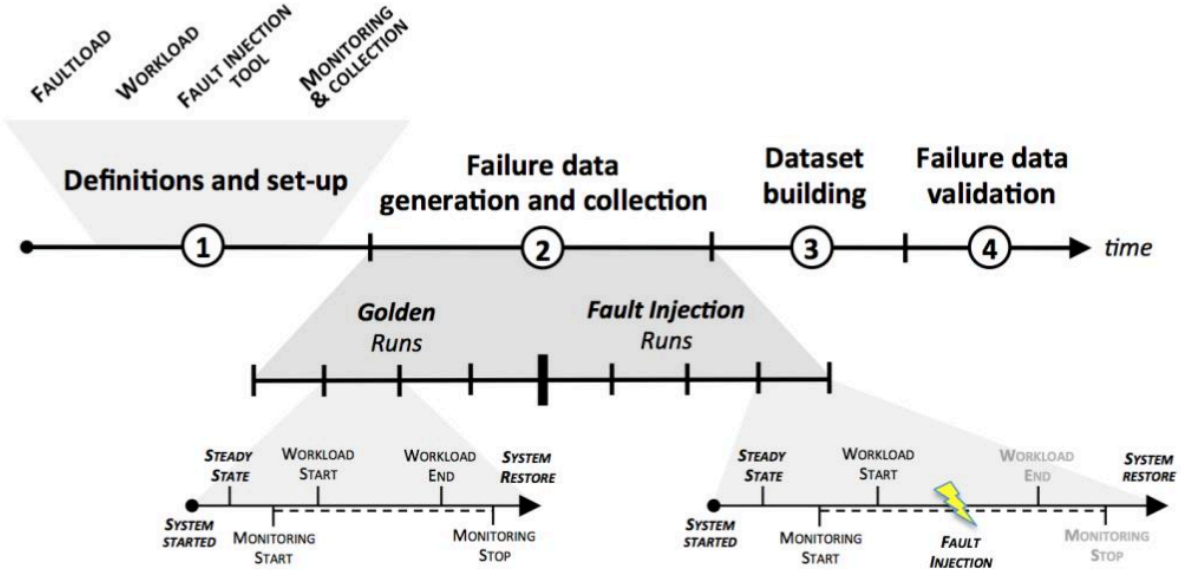
KEY CHALLENGES

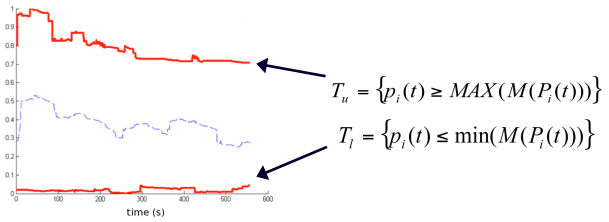
Problems with failure prediction…

- Obtaining training data is hard
  - Fortunately, failures are rare events!
- Identifying the relevant data for training is difficult
- Selecting the most adequate algorithm(s) is complex
- Furthermore: systems change over time!!!

Irrera & Vieira — Key Contributions (1)

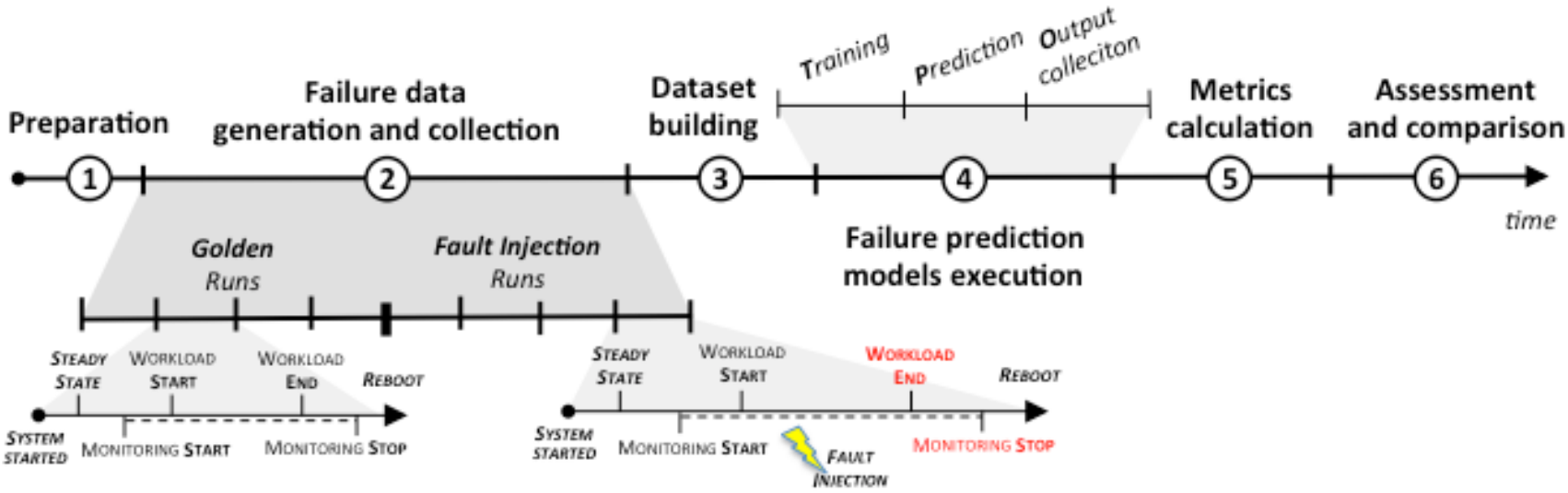
Generating failure-related data using realistic software fault injection + virtualization





Irrera & Vieira — Key Contributions (2)

Assessment and comparison of failure prediction systems



PROBLEMS…

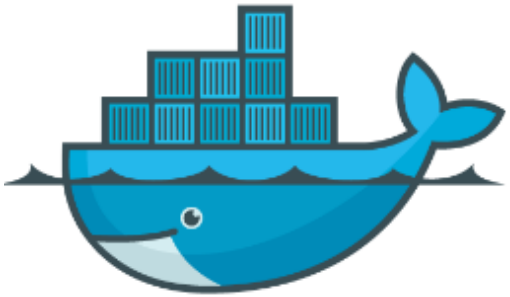
- Systems change
- Virtual machines are not the ideal solution
- Hard to implement in complex systems
- Boundaries of the system are unclear

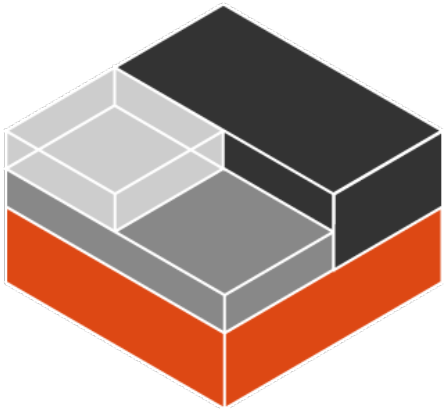
Practical Applicability

What about Containers?

- Containerized applications based on microservices are highly flexible and scalable
- Widely spread, e.g. in cloud envir
- Isolation
- Stability in the context surrounding the application
- Boundaries
- Easy to replicate and manage

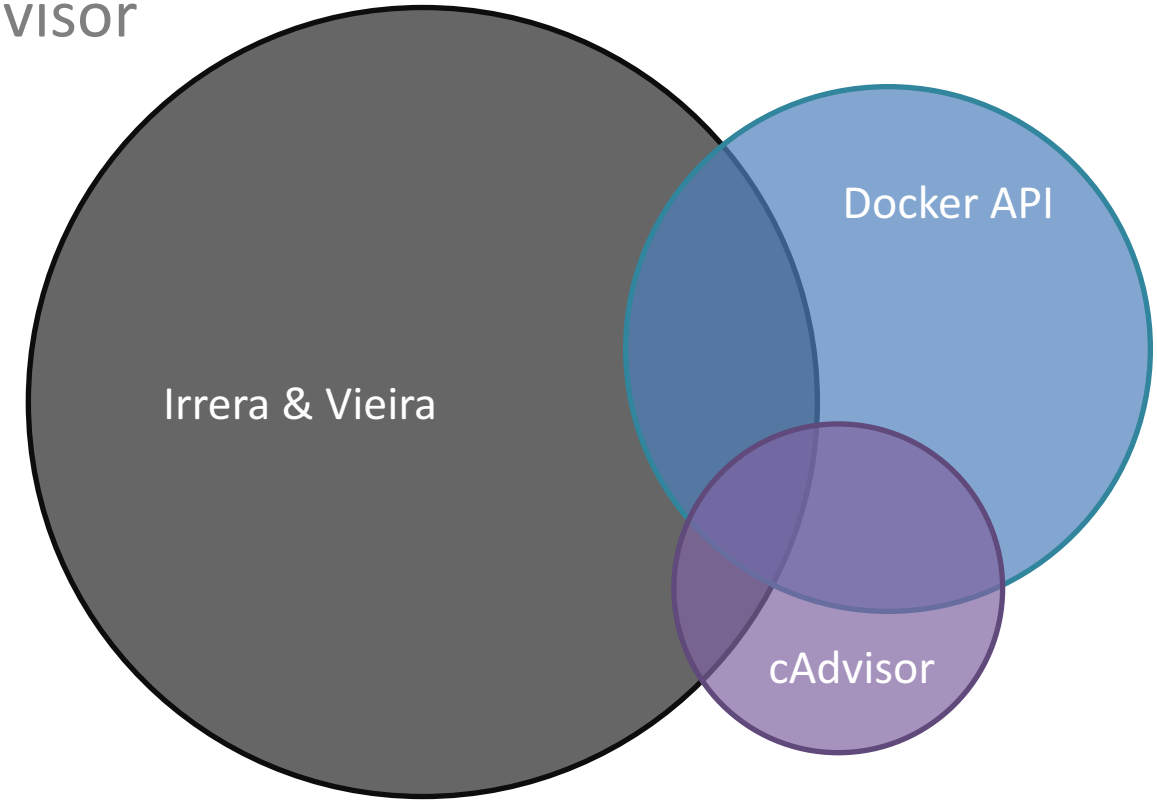
This may be what we need to make O.F.P work!





How can we do it?

- Use **data** that are **only about the** container
  - OS data cannot be considered
  - Docker API, cAdvisor



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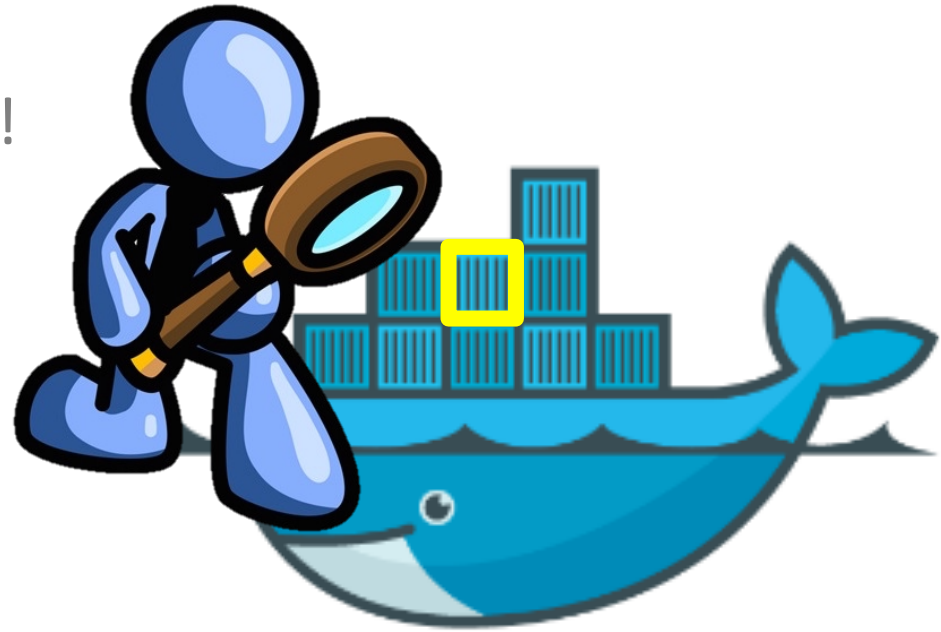
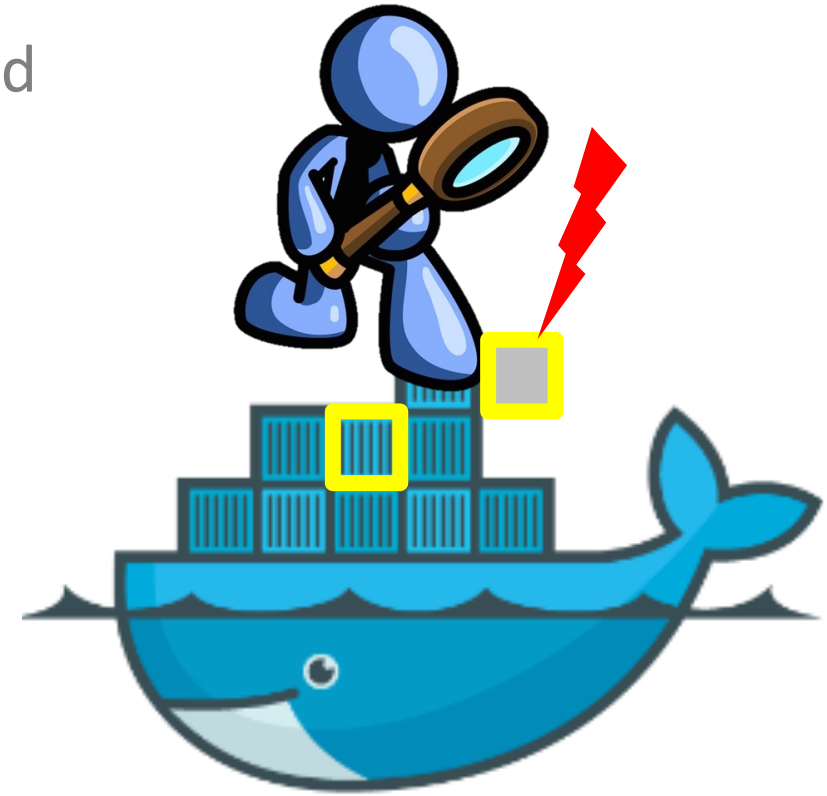
- Consider each container individually
  - Well defined boundaries!
  - Each may contribute to higher level models



How can we do it?

- Use **data** that are **only about the** container
  - OS data cannot be considered
  - Docker API, cAdvisor
- Consider each container individually
  - Well defined boundaries!
  - Each may contribute to higher level models
- Automate replication and fault injection to handle the “Online” part
  - Easier to do in containers



CHALLENGES

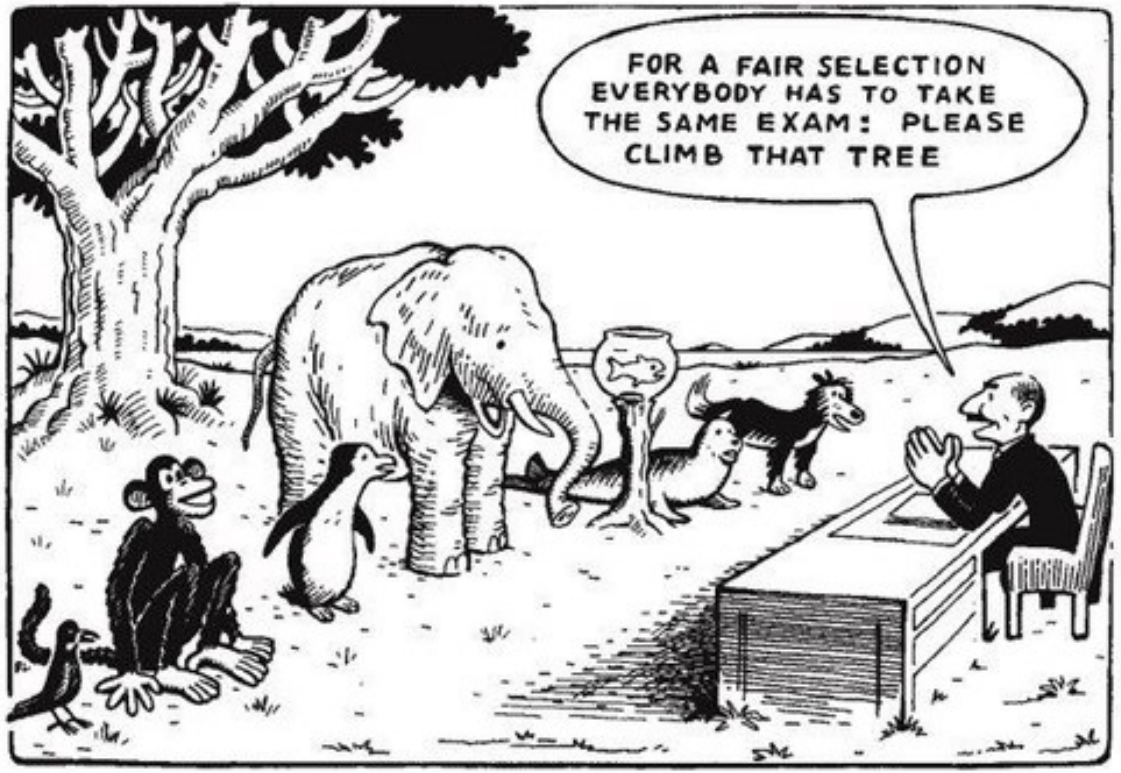
- Are the container-dependent variables enough to make state of the art approaches work?
  - We do no plan to develop new ones
- Are the monitored variables really consistent across containers running the same workloads?
- Fault injection and representativeness thereof

SUMMARY

- We believe that practical applicability is the current key issue
- Containers make a set of assumptions valid that may help us to solve the problem
- We are just starting…

- **Not a Silver Bullet**
  - Obviously, this cannot be applied to every application
  - Application that fit the containerized model are suited
    - e.g. Microservices

QUESTIONS?



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