DICE: Developing Data-Intensive Cloud Applications with Iterative Quality Enhancements

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DICE Horizon 2020 Project
Grant Agreement no. 644869
http://www.dice-h2020.eu

Funded by the Horizon 2020
Framework Programme of the European Union

Motivation

- Software market rapidly shifting to Big Data
  - 32% compound annual growth rate in EU through 2016
  - 35% Big data projects are successful [CapGemini 2015]
- ICT-9 call focused on SW quality assurance (QA)
  - ISTAG: call to define environments "*for understanding the consequences of different implementation alternatives (e.g. quality, robustness, performance, maintenance, evolvability, ...)*"
- QA evolving too slowly compared to the technology trends (Big data, Cloud, DevOps ...)
  - DICE aims at closing the gap

Overview and goals

- MDE often features quality assurance (QA) techniques for developers
- How should quality-aware MDE support data-intensive software systems?
  - Existing models and QA techniques largely ignore properties of data
  - Characterize the behavior of new technologies
- DICE: a quality-aware MDE methodology inspired by DevOps for data-intensive cloud applications

DICE Project

- Horizon 2020 Research & Innovation Action (RIA)
  - Quality-Aware Development for Big Data applications
  - Feb 2015 - Jan 2018, 4M Euros budget
  - 9 partners (Academia & SMEs), 7 EU countries

Imperial College London

XLAB NOT IDLE

IeAT

Universidad Zaragoza

NETFECTIVE Creative Technology

ATC ATHENS TECHNOLOGY CENTER

POLITECNICO DI MILANO

prodevelop Integración de tecnologías

flexiant™ your cloud simplified

High-Level Objectives

- Tackling skill shortage and steep learning curves
  - Data-aware methods, models, and OSS tools
- Shorter time to market for Big Data applications
  - Cost reduction, without sacrificing product quality
- Decrease development and testing costs
  - Select optimal architectures that can meet SLAs
- Reduce number and severity of quality incidents
  - Iterative refinement of application design

Some Challenges in Big Data…

- Lack of quality-aware development for Big Data
  - How to described in MDE Big Data technologies
    - Spark, Hadoop/MapReduce, Storm, Cassandra, ...
    - Cloud storage, auto-scaling, private/public/hybrid, ...
- Today no QA toolchain can help reasoning on data-intensive applications
    - What if I double memory?
    - What if I parallelize more the application?

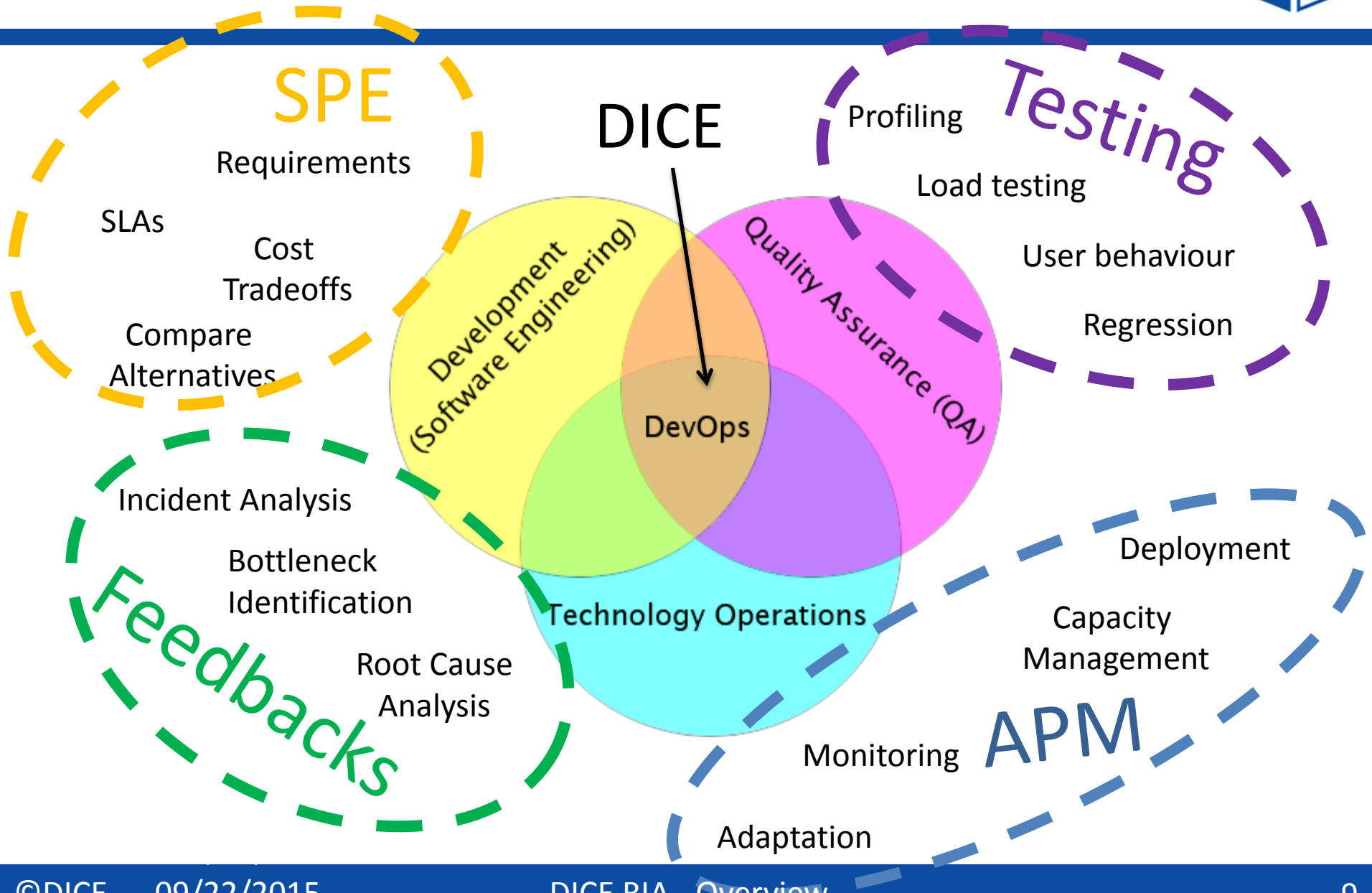
… in a DevOps fashion

- Software development methods are evolving
- DevOps closes the gap between Dev and Ops
  - From agile development to agile delivery
  - Lean release cycles with automated tests and tools
  - Deep modelling of systems is the key to automation

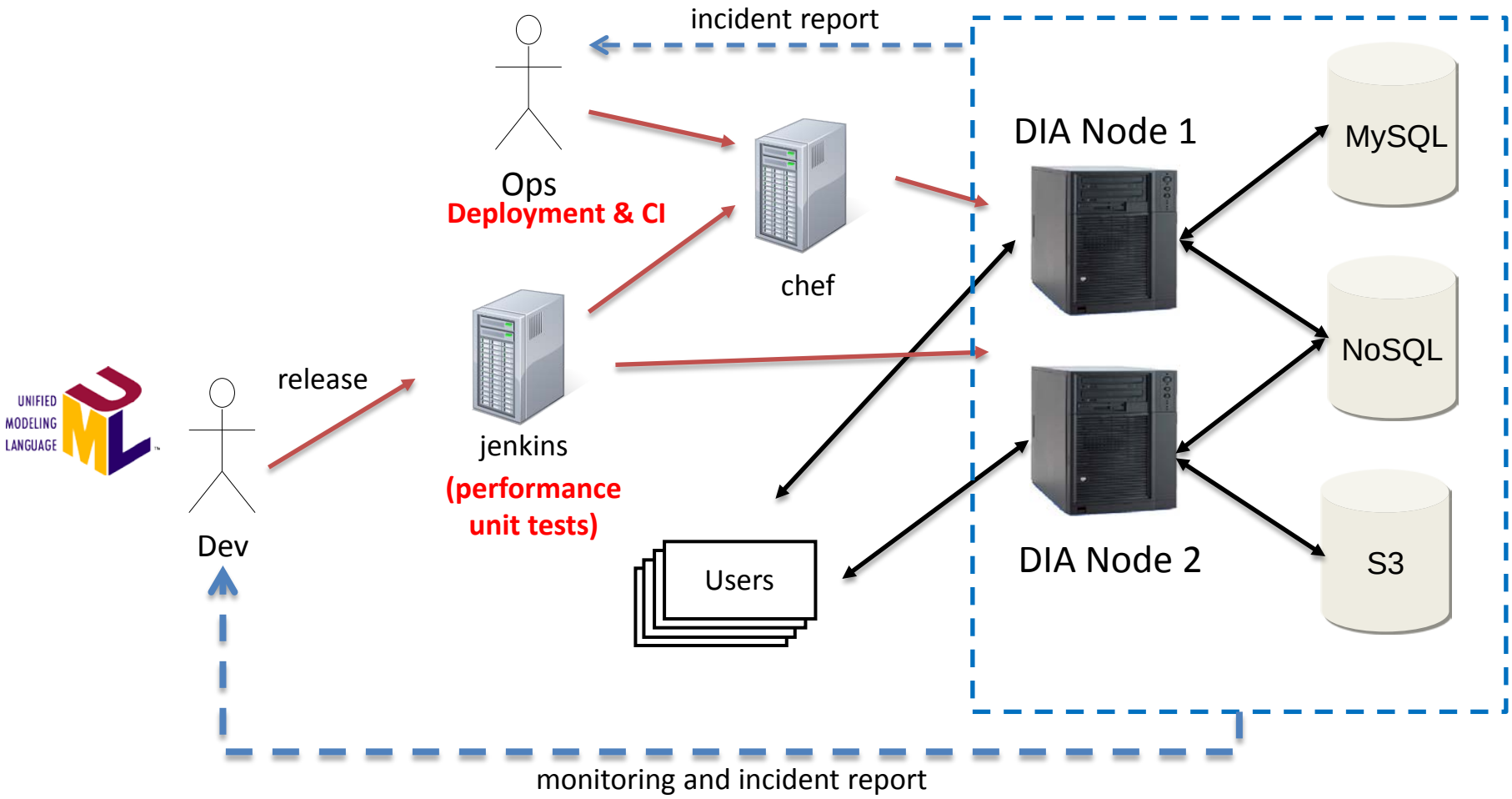
Demonstrators

Case study	Domain	Features & Challenges
Distributed data-intensive media system (ATC)	• **News & Media** • **Social media**	• Large-scale software • Data velocities • Data volumes • Data granularity • Multiple data sources and channels • Privacy
Big Data for e-Government (Netfective)	• **E-Gov application**	• Data volumes • Legacy data • Data consolidation • Data stores • Privacy • Forecasting and data analysis
Geo-fencing (Prodevelop)	• **Maritime sector**	• Vessels movements • Safety requirements • Streaming & CEP • Geographical information

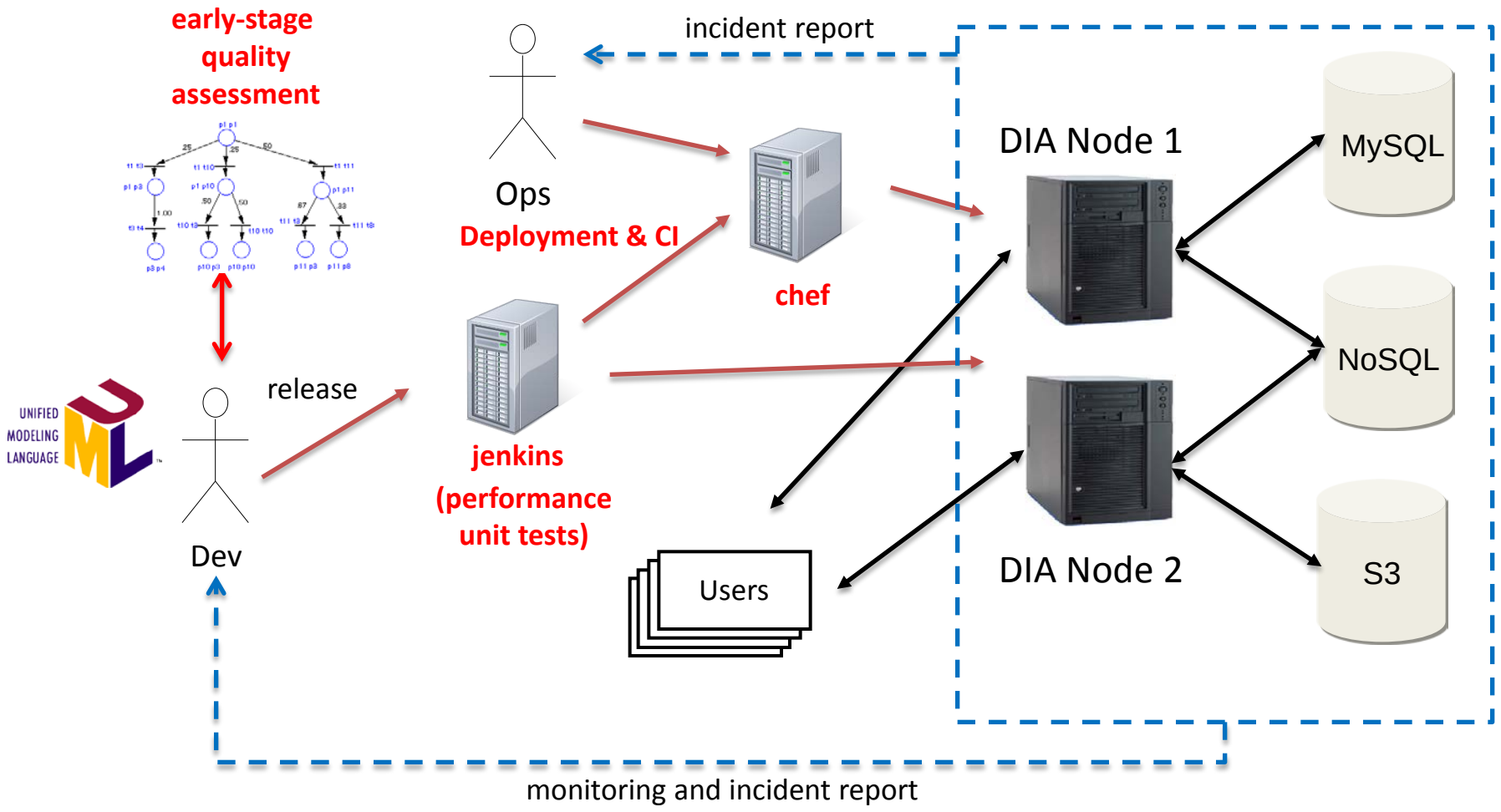
Bringing QA and DevOps together



DevOps in DICE: Measurement



DevOps in DICE: Early-stage MDE

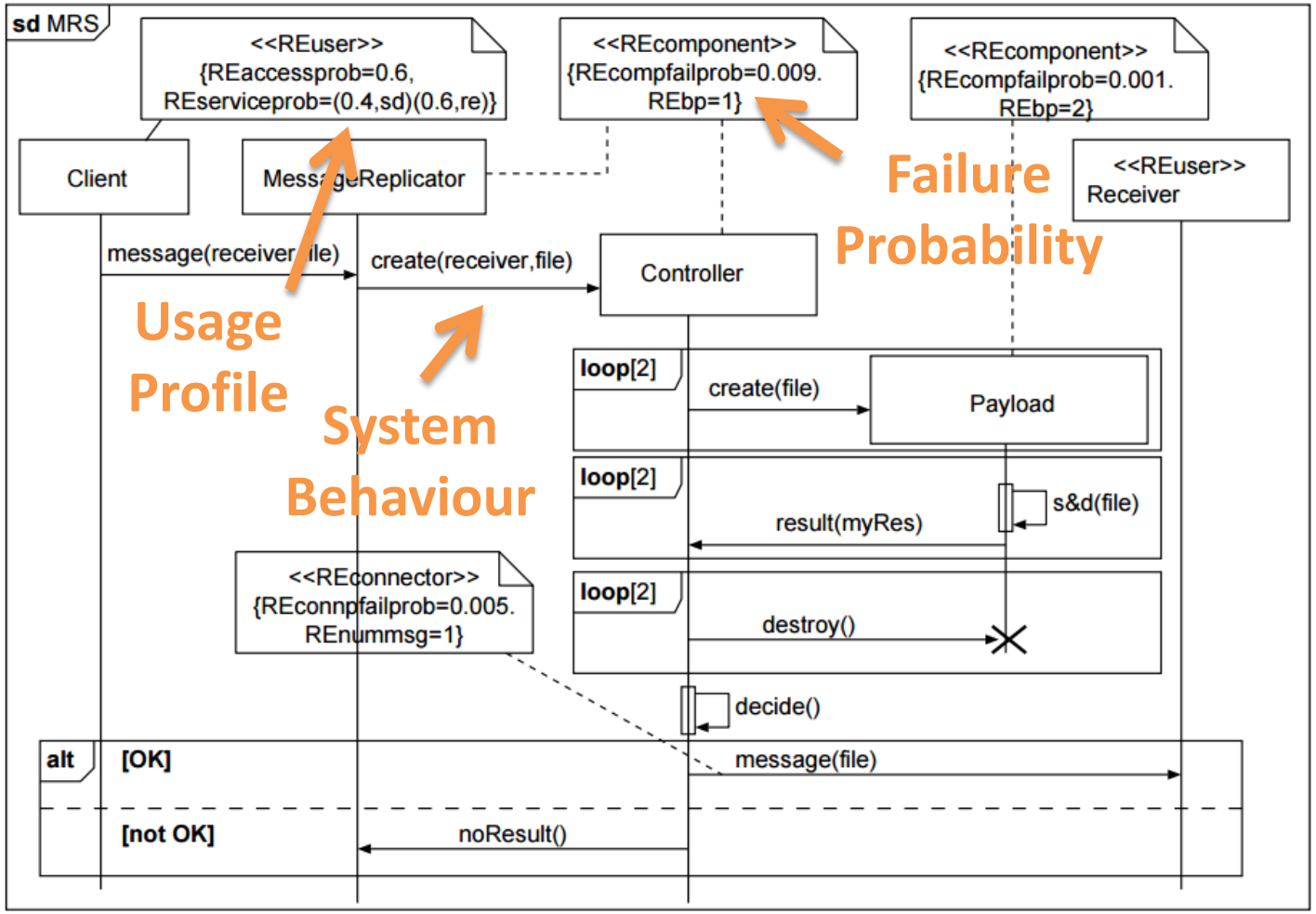


Quality Dimensions

- Reliability
  - Availability
  - Fault-tolerance
- Efficiency
  - Performance
  - Costs
- Safety & Privacy
  - Verification (e.g., deadlines)
  - Data protection

Quality-Aware MDE

- UML MARTE profile, UML DAM profile, Palladio, …



Quality-Aware MDE

UNIFIED MODELING LANGUAGE™ MARTE

Platform-Indep. Model

Architecture Model

Platform-Specific Model

Domain Models

QA Models

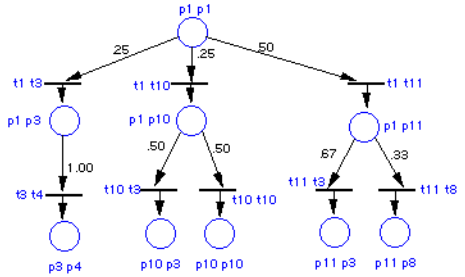
Platform Description

Code stub generation

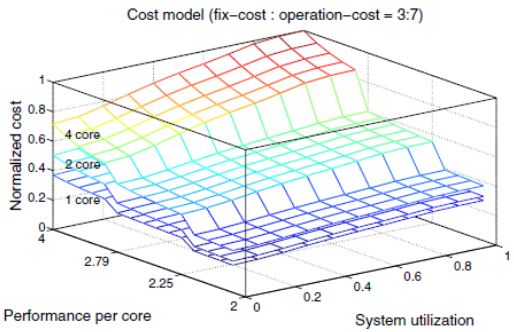
amazon web services™

hadoop

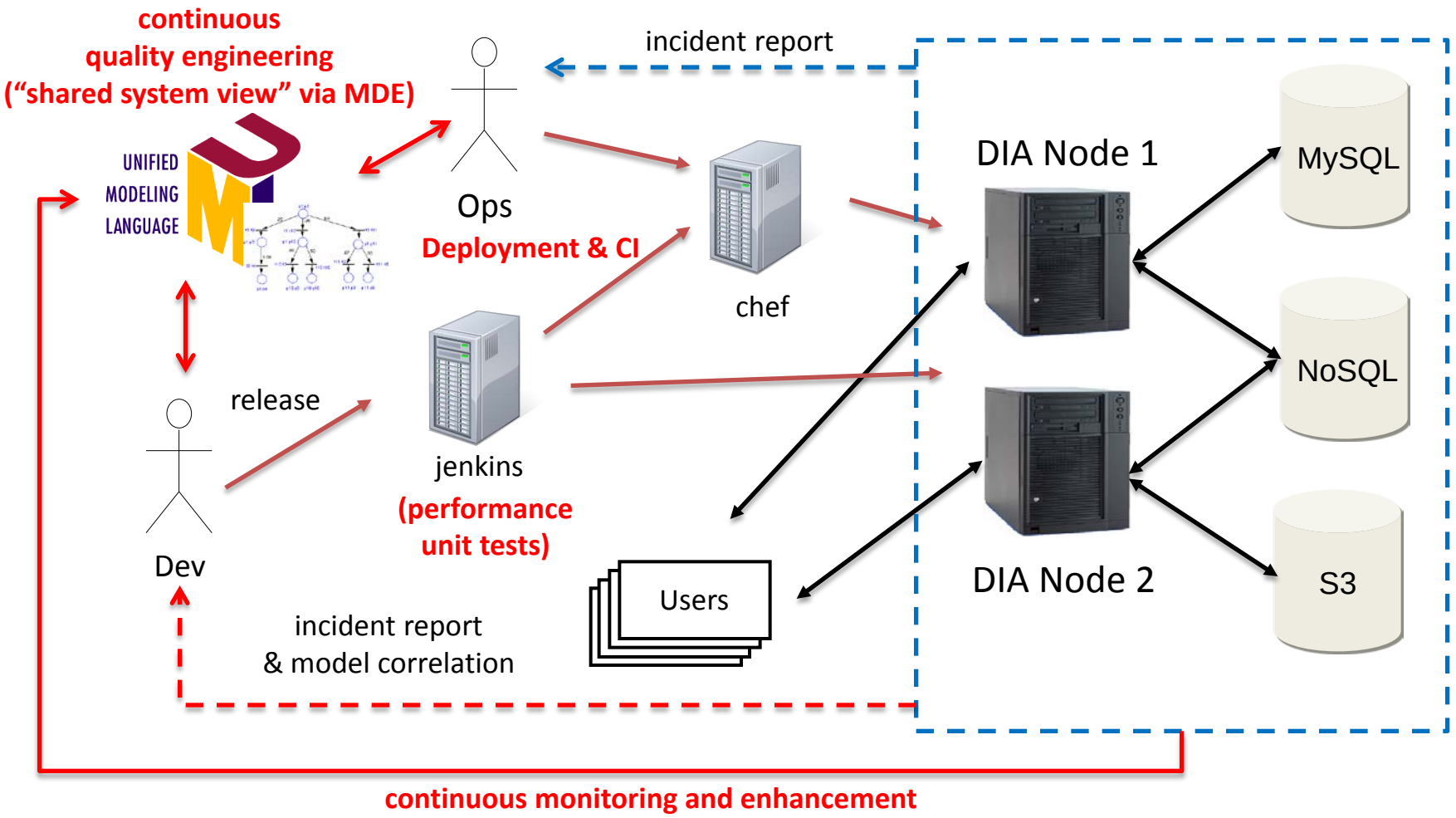
Simulation Tools



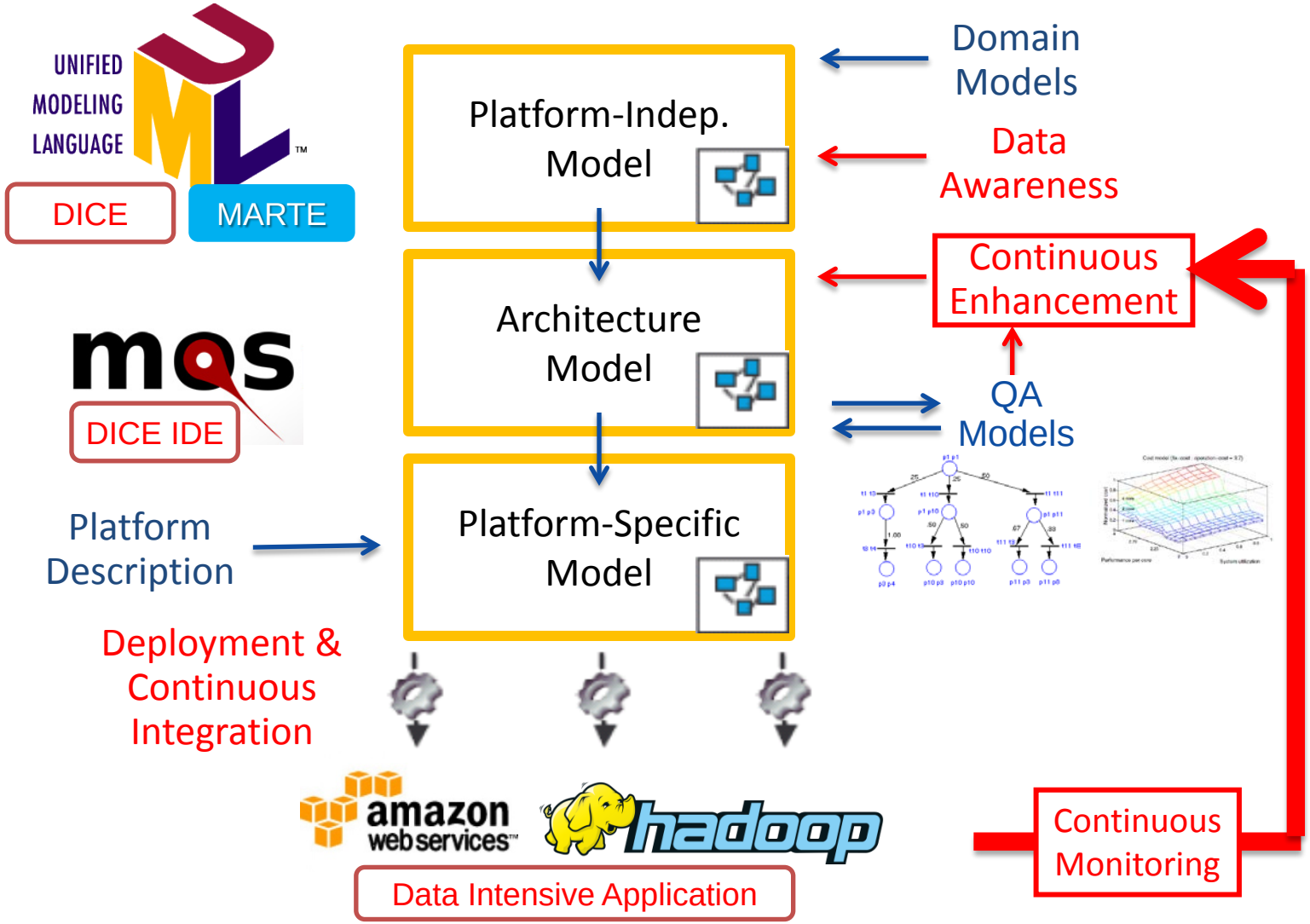
Cost Optimization Tools



DevOps in DICE: Enhancement



DICE Integrated Solution



Year 1 Milestones

Milestone	*Deliverables*
Baseline and Requirements - July 2015 [**COMPLETED**]	• State of the art analysis • Requirement specification • Dissemination, communication, collaboration and standardisation report • Data management plan
Architecture Definition - January 2016	• Design and quality abstractions • DICE simulation tools • DICE verification tools • Monitoring and data warehousing tools • DICE delivery tools • Architecture definition and integration plan • Exploitation plan

Thank you

www.dice-h2020.eu