# Quality assessment in DevOps:

## Automated Analysis of a Tax Fraud Detection System

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University of Zaragoza, Netfective Technology


Developing Data-Intensive Cloud Applications With Iterative Quality Enhancements

# Big Blu

## eGov Tax Fraud Detection System
## Under Development by Netfective Technology

# Big Blu

## eGov Tax Fraud Detection System Under Development by Netfective Technology

- Tax fraud represent a huge problem for governments.


https://ec.europa.eu/taxation_customs/fight-against-tax-fraud-tax-evasion/missing-part_en

- EU has estimated tax evasion to be of the order of 1 trillion euros

# Big Blu

Big Blu is a Data Intensive Application in the field of *Big Data*

- **Volume:** millions of daily tax operations – combined with history
- **Variety:** data coming from different sources:
  - VAT
  - Banks
  - Incomes
  - ...
- **Velocity:** data arrives too fast in some periods of time (tax declaration periods)
- **Variability and Volatility:** data changes fast:
  - Relocations of people
  - Updated banking details
- **Veracity, Validity** and **Value:** data contains noise such as legitimate exemptions

# Big Blu

Big Blu is developed following Agile and DevOps principles

- Iterative process with incremental iterations pursuing
  - Quick design
  - Quick delivery of enhancements
  - Quick feedback

- Bring closer Development and Operations activities to improve the effectiveness of each iteration
  - Faster iterations since both activities share the same UML models
  - Higher proportion of iterations achieve satisfactory results

# Big Blu

- Software Architecture composed of 3 main layers:
  - GUI: web based application. Unique interface
  - Web Services: implement RESTful interoperability and deployed on Tomcat
  - Back-end: Data processing elements

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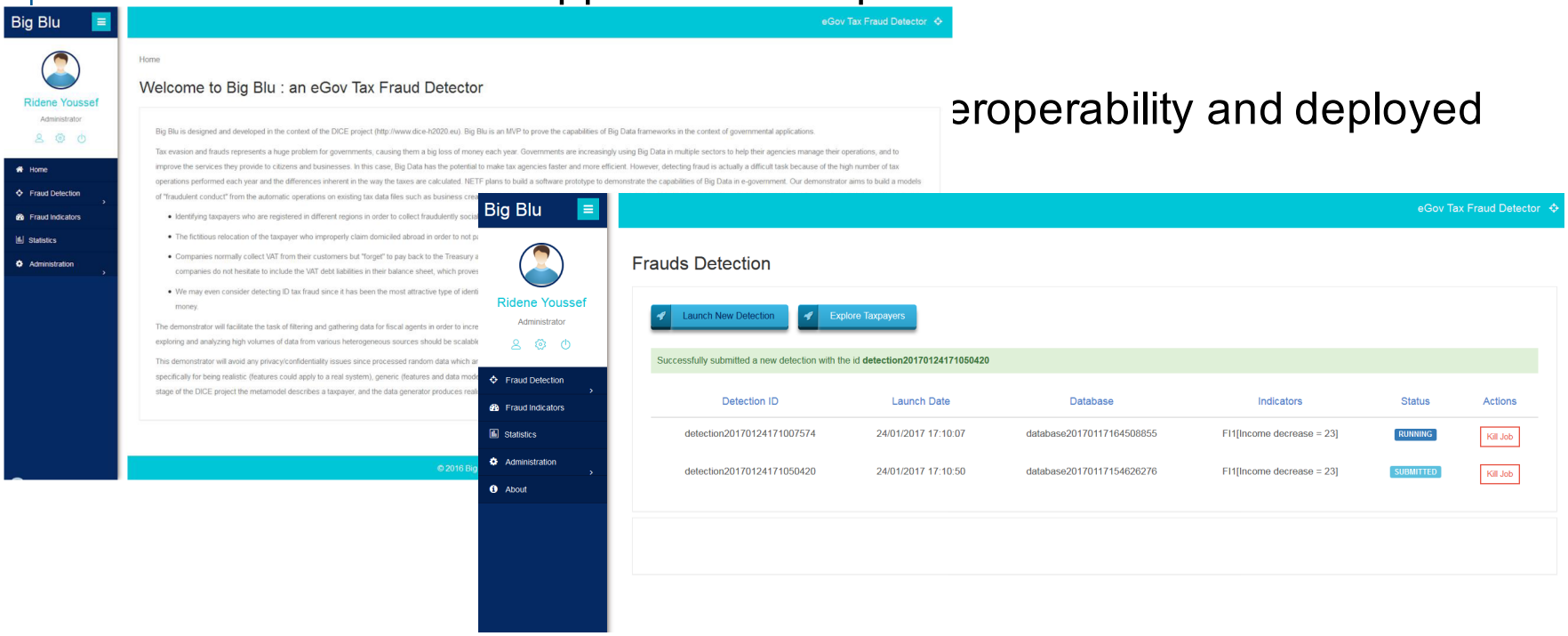


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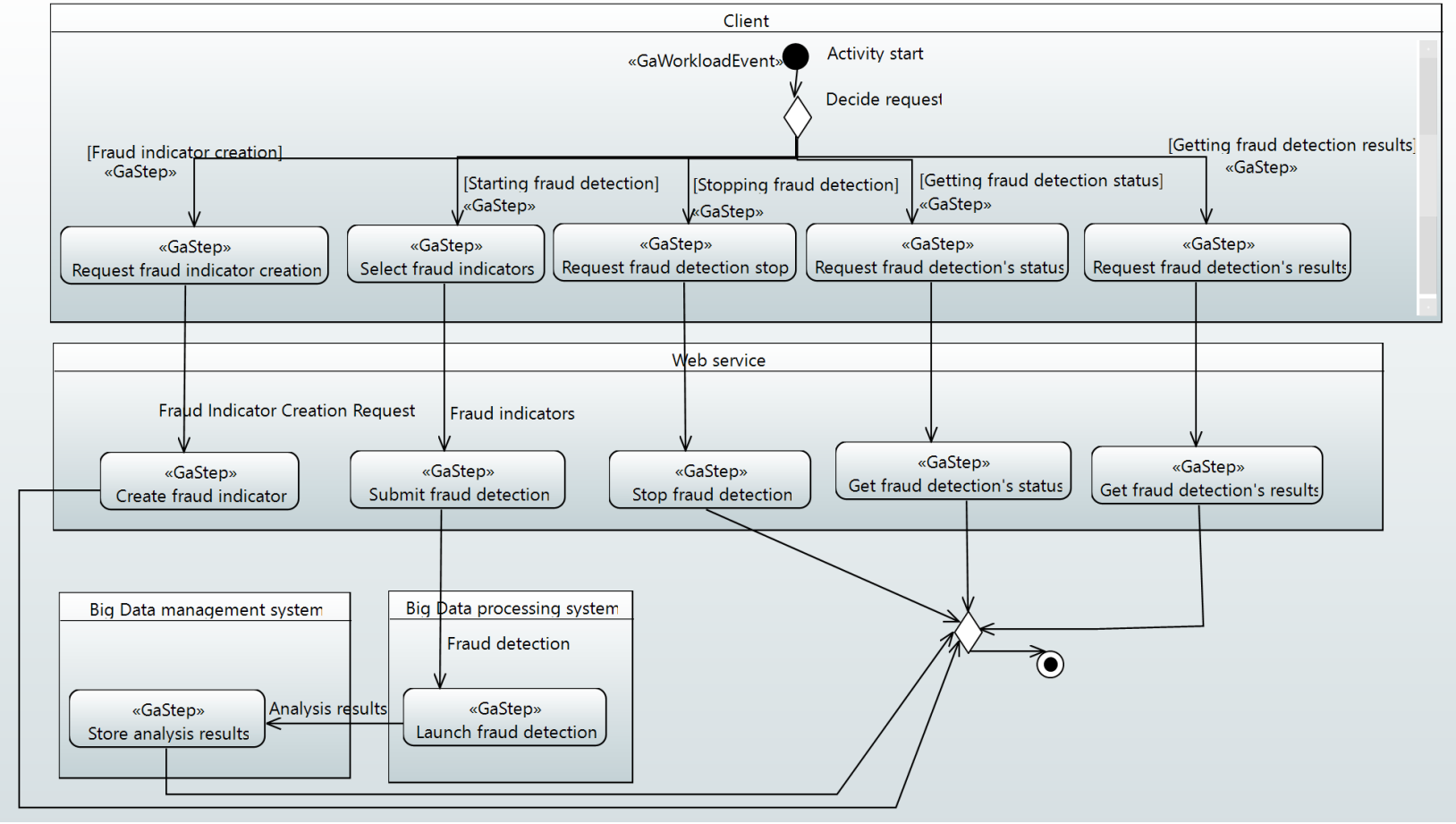

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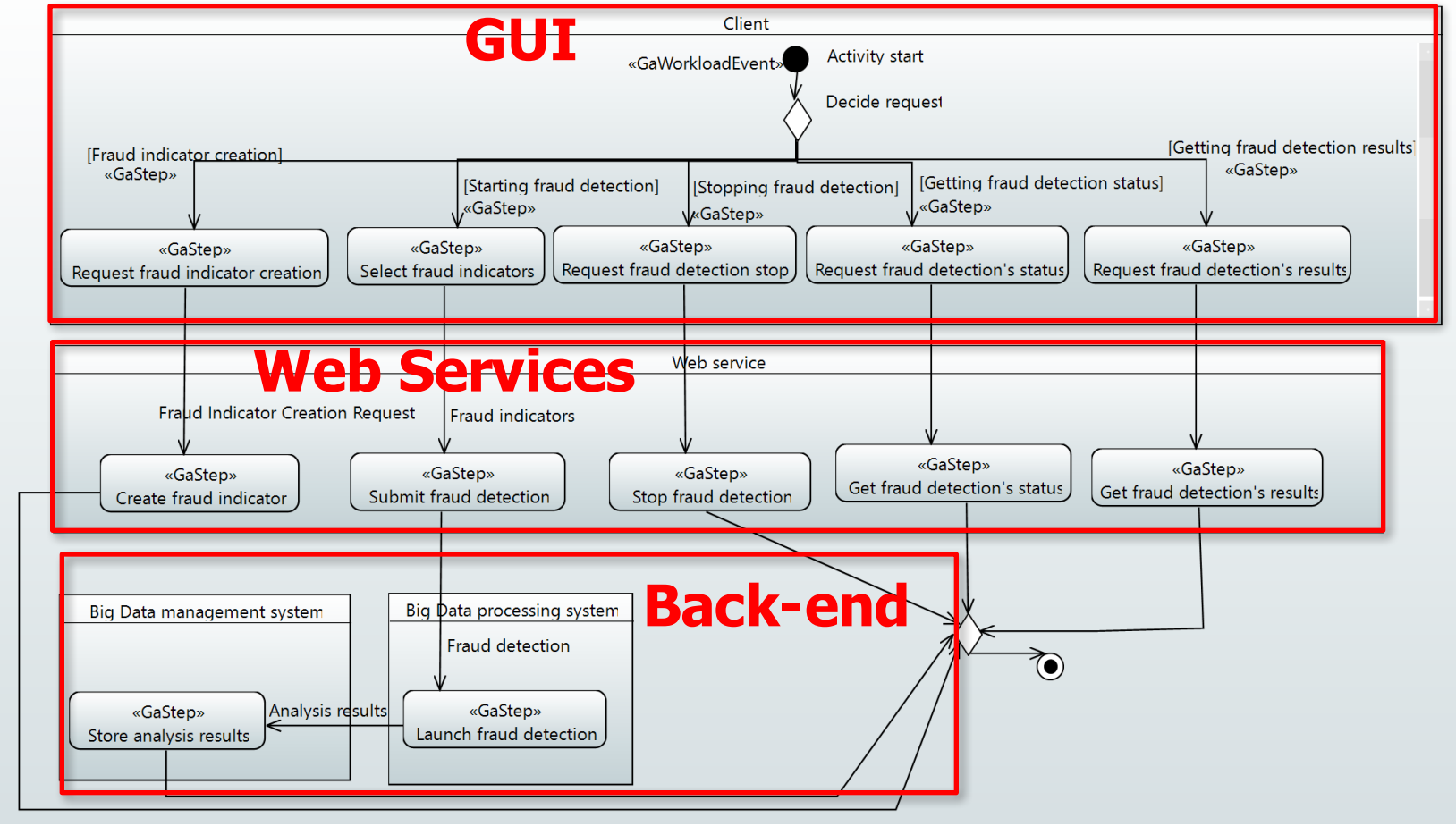

# DICE approach

Researches towards building an quality-driven framework for development, deployment, monitoring and continuous improvement of Data-Intensive Cloud Applications.

- Pursues developments through Iterative Quality enhancements
- Delivers a toolchain for DevOps:
  - Design
  - Quality analysis
  - Deployment
  - Testing
  - Monitoring (collect data, visualization, anomaly detection, trace checking)
  - Enhancement

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+ PROFILING

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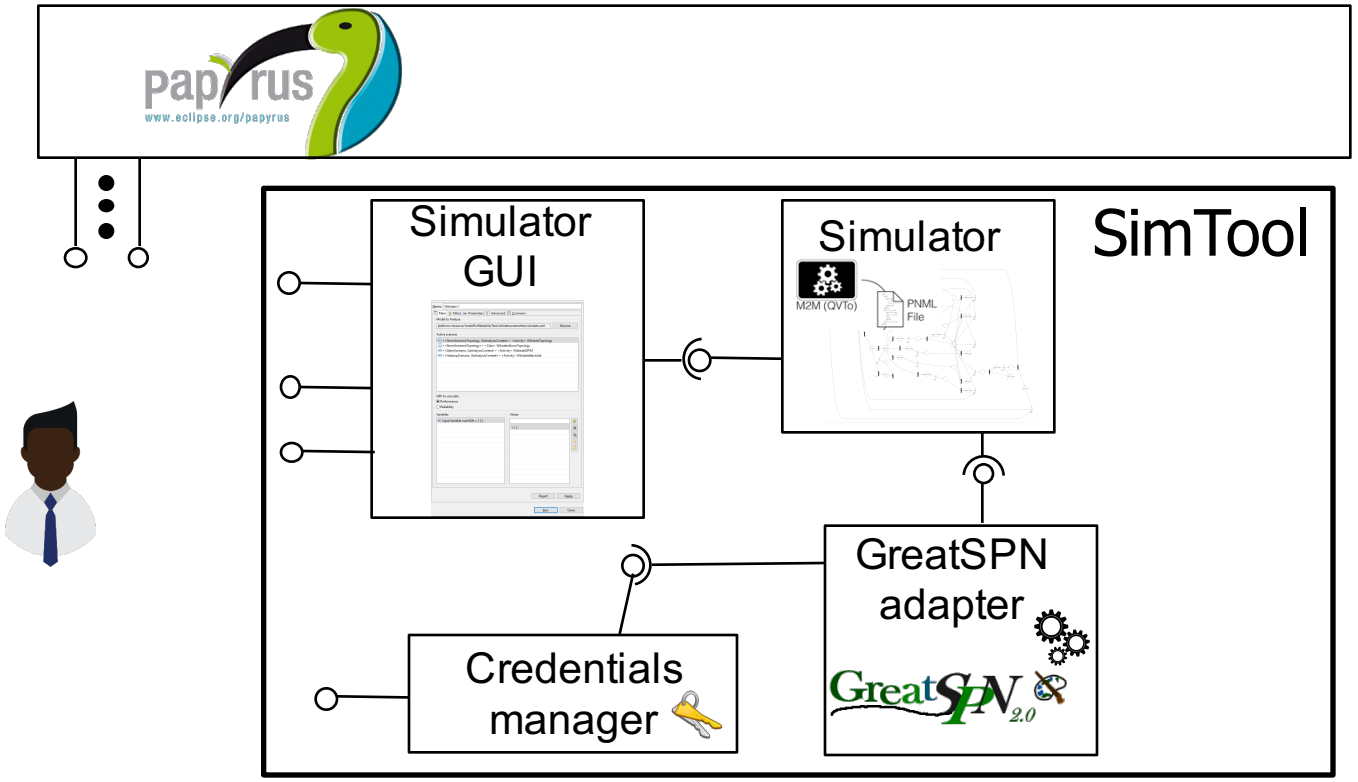
# DICE Simulation Tool

- Based on eclipse plugins eclipse Delivered with DICE



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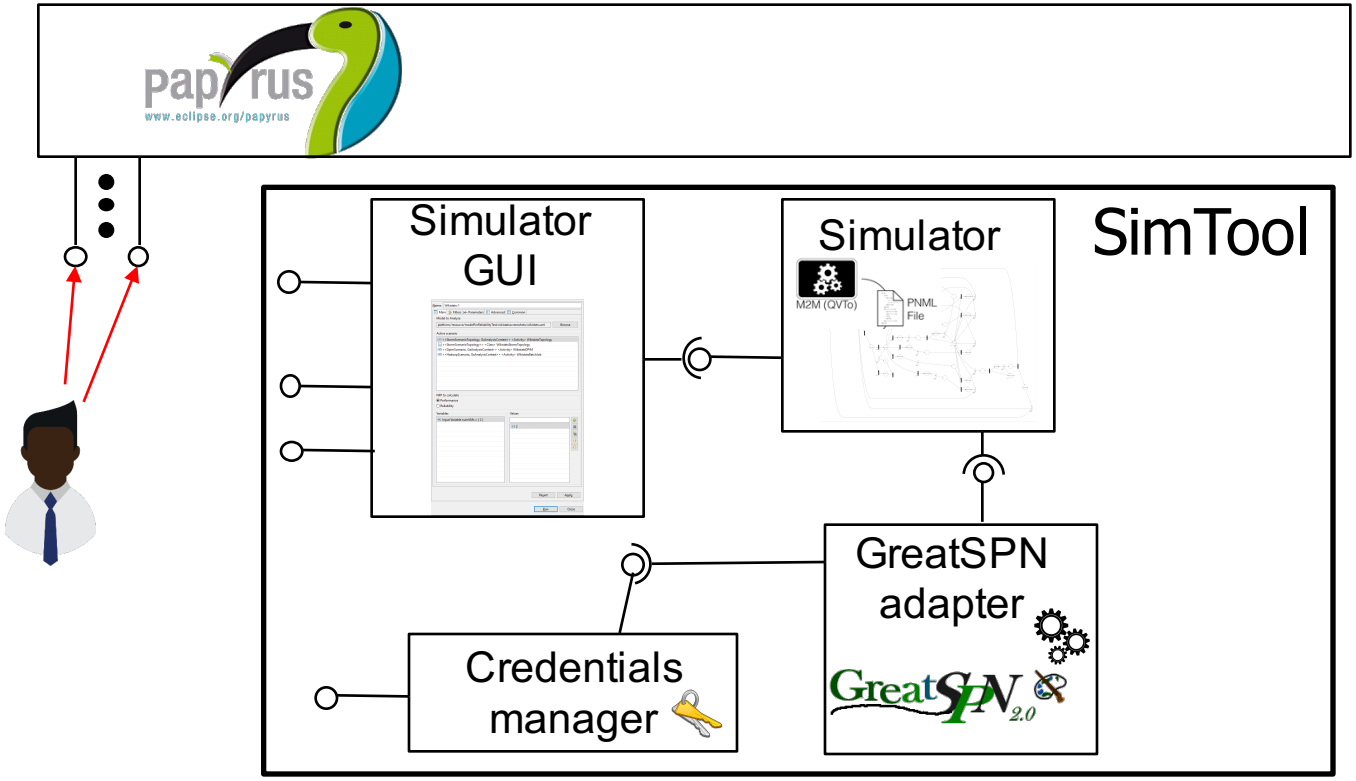

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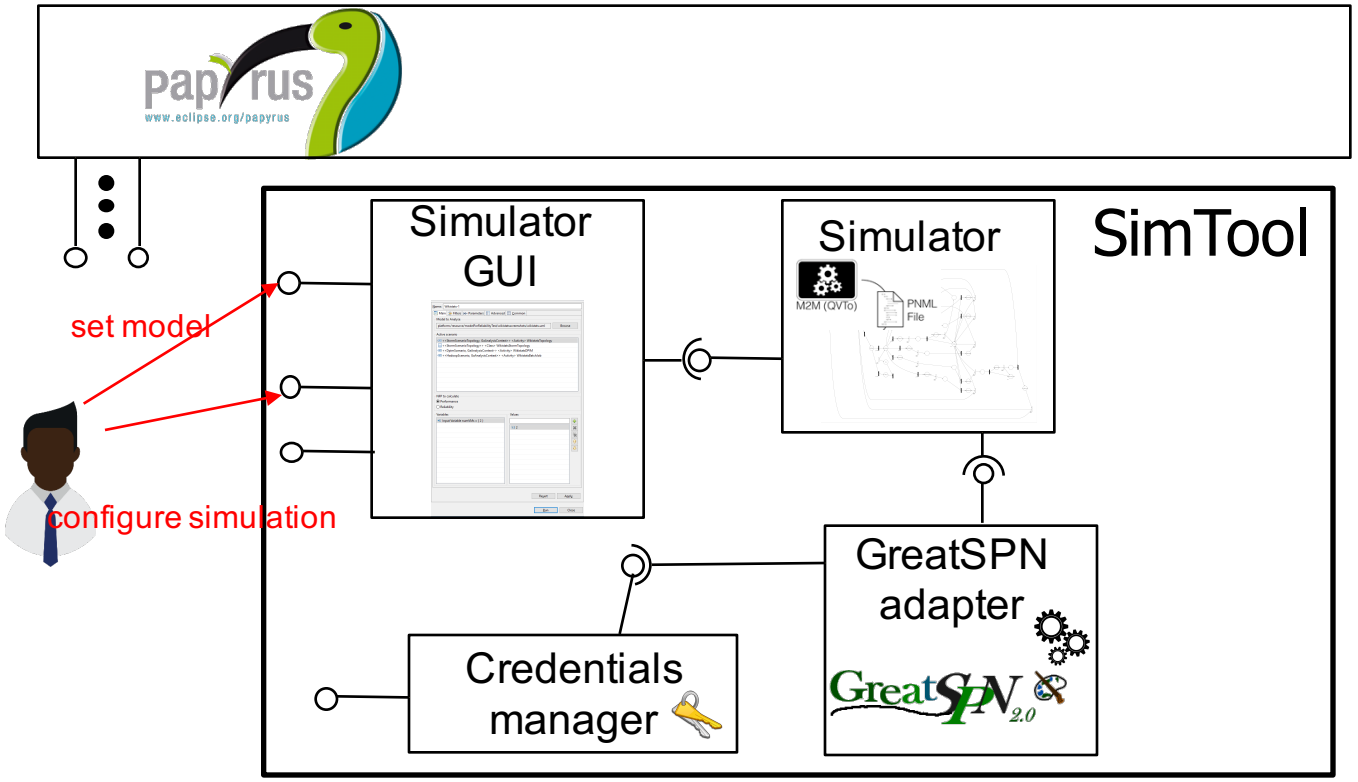

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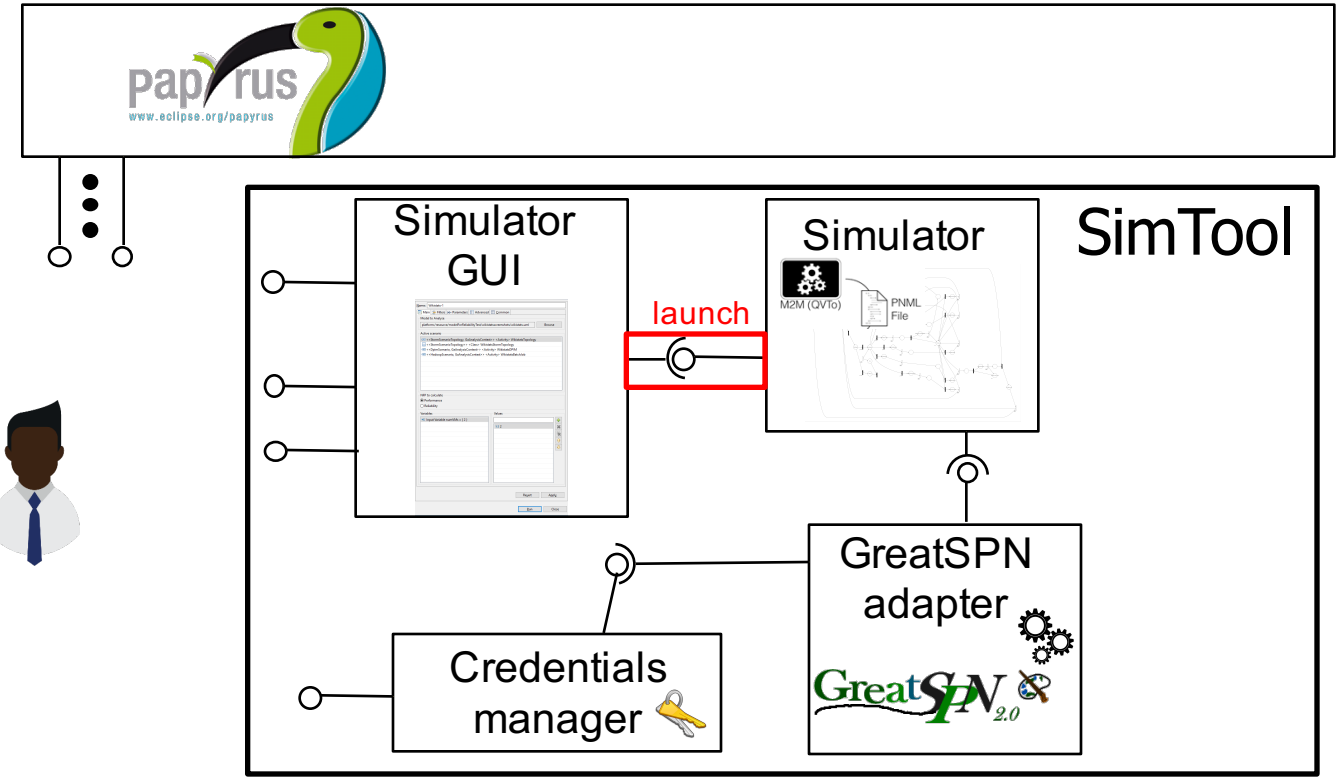

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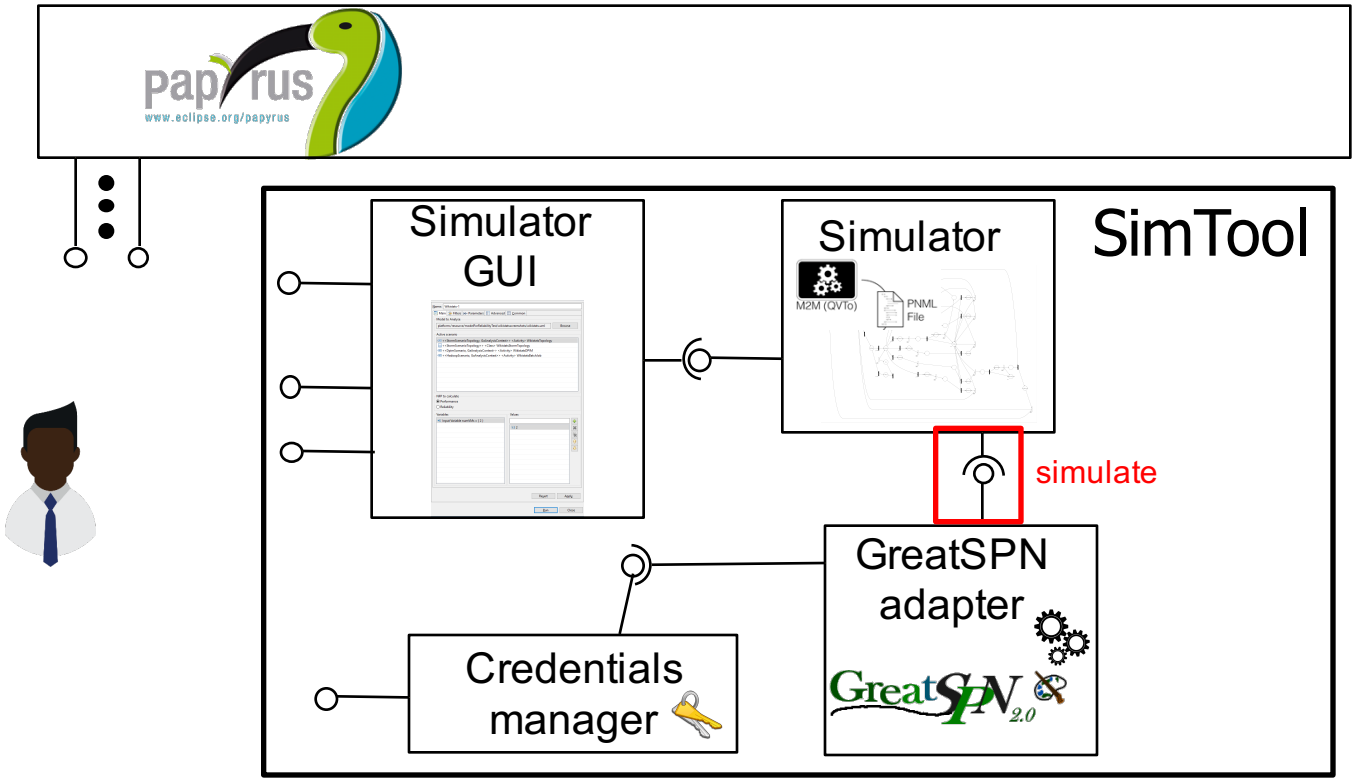

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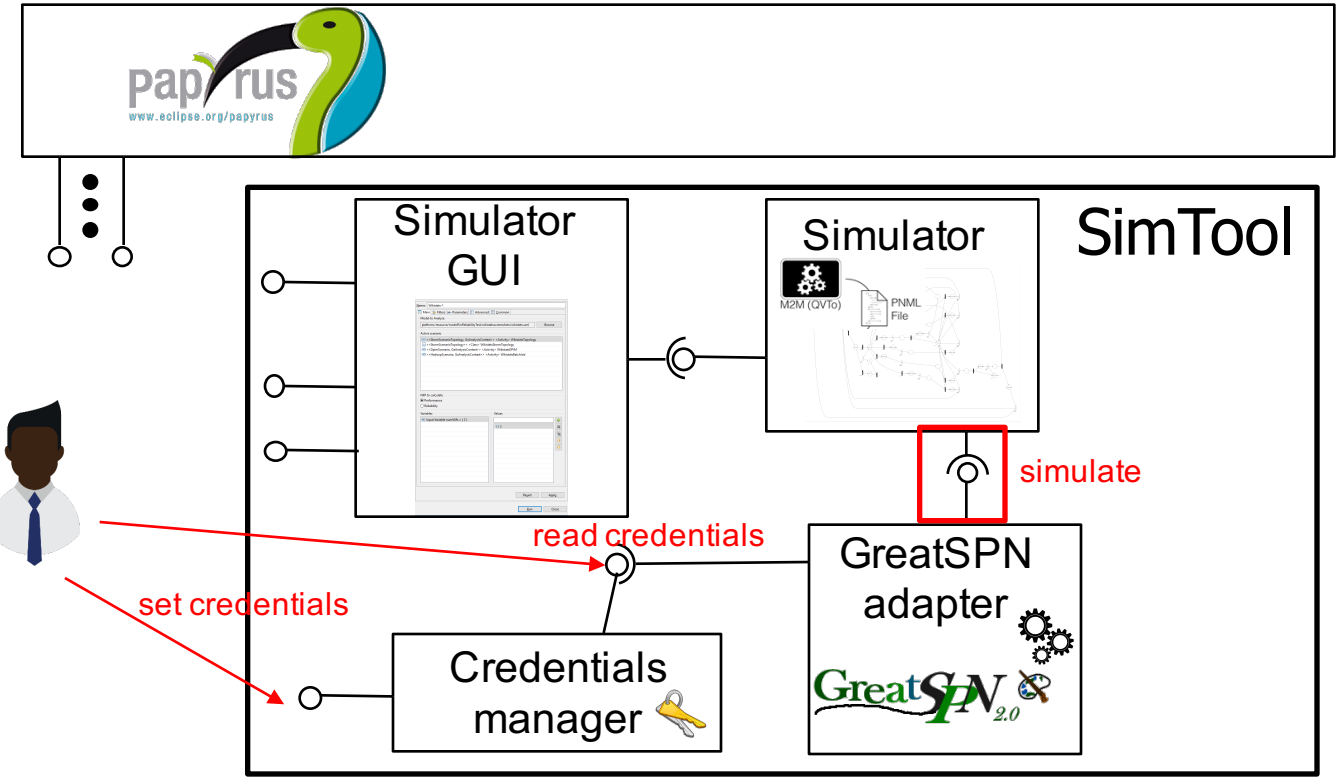

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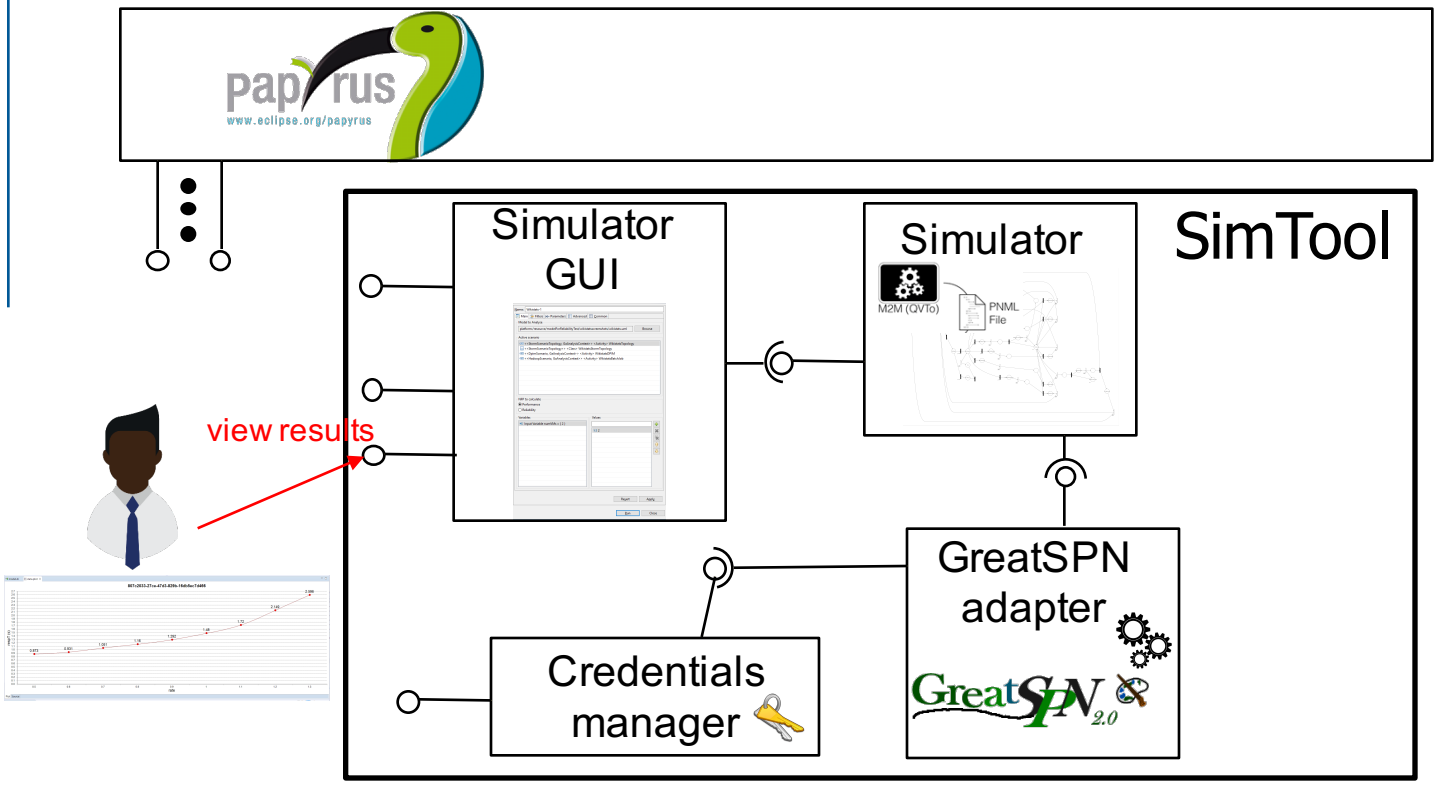


# DICE Simulation Tool

Usefulness in Agile cycles following DevOps

- Scenario 1: Development of new functionalities

**PROBLEM**

- In agile cycles, the required quality of the new functionalities may not be clear for developers
  - The quality requirements refer to the overall system quality

  Monitored information is available

**CONSEQUENCES**

- Obtained quality is not good enough and development cycle has to be repeated

# DICE Simulation Tool

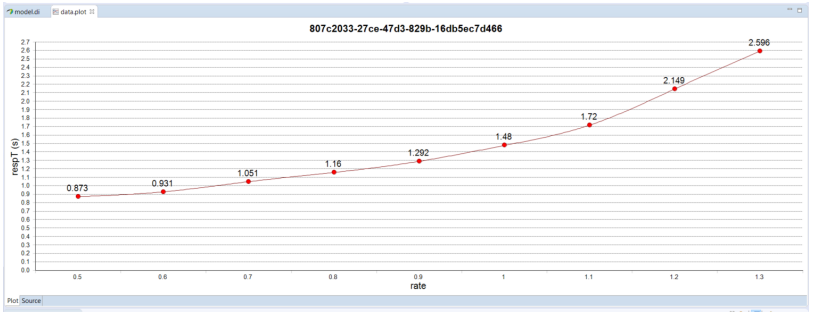
Usefulness in Agile cycles following DevOps

- Scenario 1: Development of new functionalities

## APPROACH TO SOLUTION

- Obtain values for ``appropriate quality'' of the new functionality that can be already asserted during the unit tests
  - Analyze the expected system quality based on *what-if* values of the quality offered by the new functionality.

    E.g., predict system response time considering different resource demands of the new functionality




- Deliver a functionality that passes these unit tests

# DICE Simulation Tool

Usefulness in Agile cycles following DevOps

- Scenario 1: Development of new functionalities

**APPROACH TO SOLUTION**

- Obtain val… …iate q… …e… …y functionality that can… …dy a… …s unit…
  - An… …e expected sys… …based on *what*… …s of the qu… …fered by the new f… …lity.
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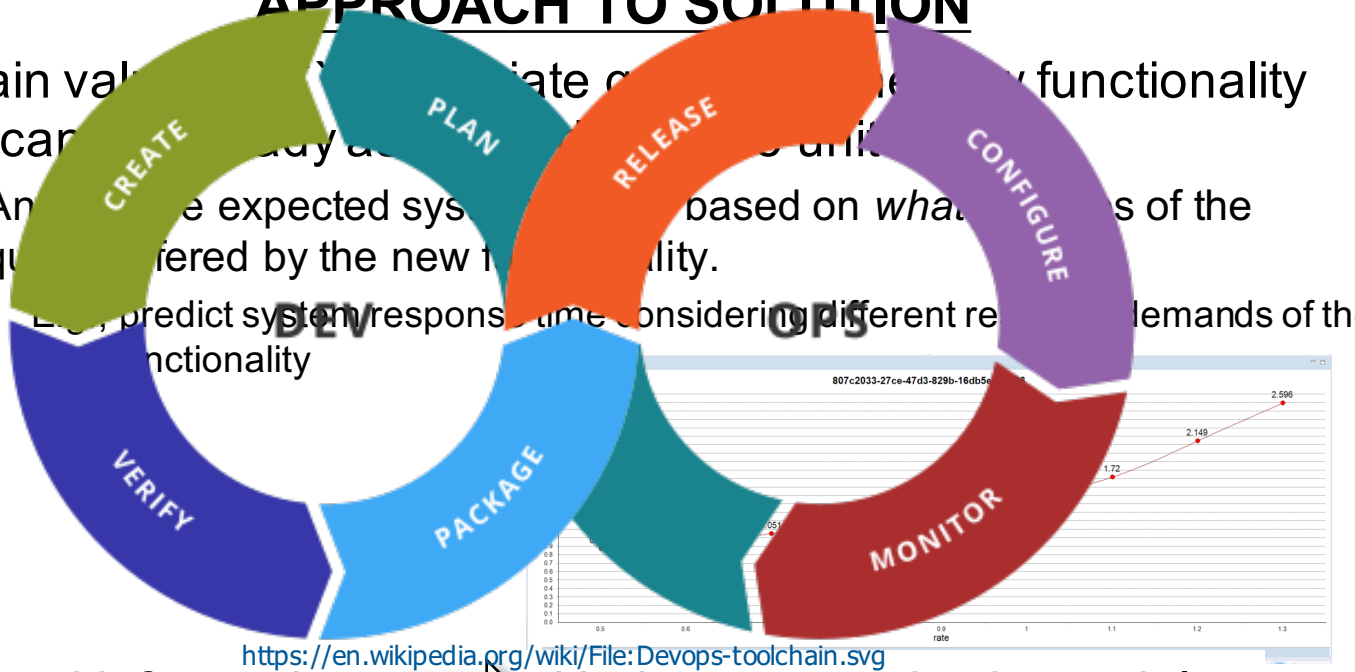



https://en.wikipedia.org/wiki/File:Devops-toolchain.svg

Monitored information ⇨ Update properties in models

# DICE Simulation Tool

Usefulness in Agile cycles following DevOps

- Scenario 2: Maintenance of functionalities

**PROBLEM**

- Quality of a functionality has to be improved…
  - Due to changes in the characteristics or utilization profile
  - Due to improvable designs and new time restrictions
- …and can be improved in different phases of DevOps toolchain

**CONSEQUENCES**

- Modifications do not achieve the expected quality
- Modifications result more expensive than necessary

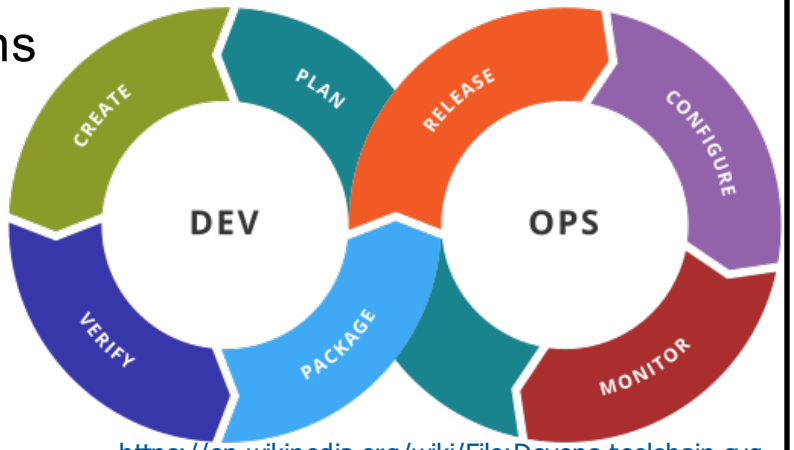
# DICE Simulation Tool

Usefulness in Agile cycles following DevOps

- Scenario 2: Maintenance of functionalities

## APPROACH TO SOLUTION

- Update the models with recent monitored data
- Identify quality issues
- Evaluate different possibilities to solve the issues
- Decide best maintenance actions

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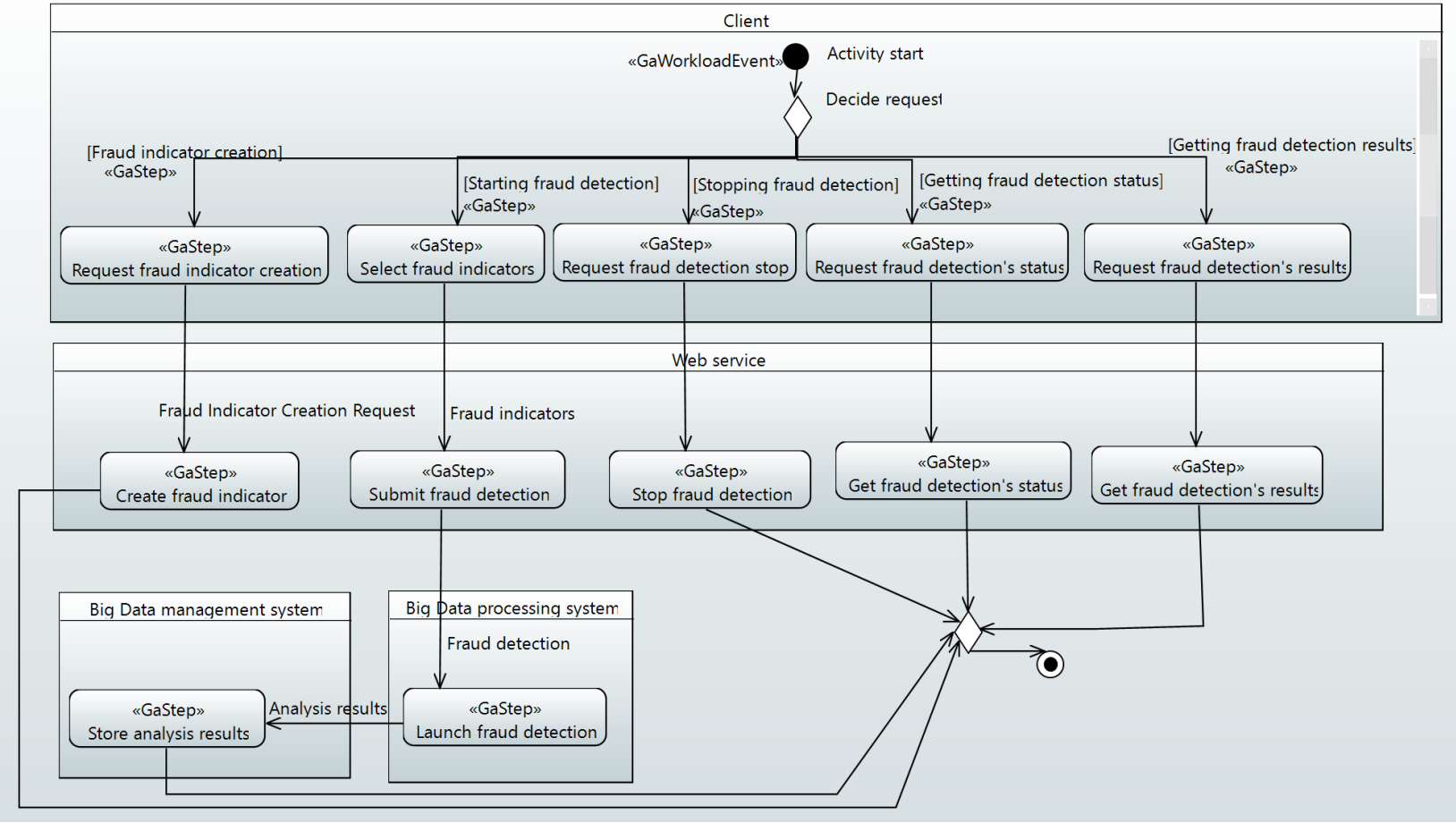
# Big Blu Quality assessment

- Quality malfunction reported



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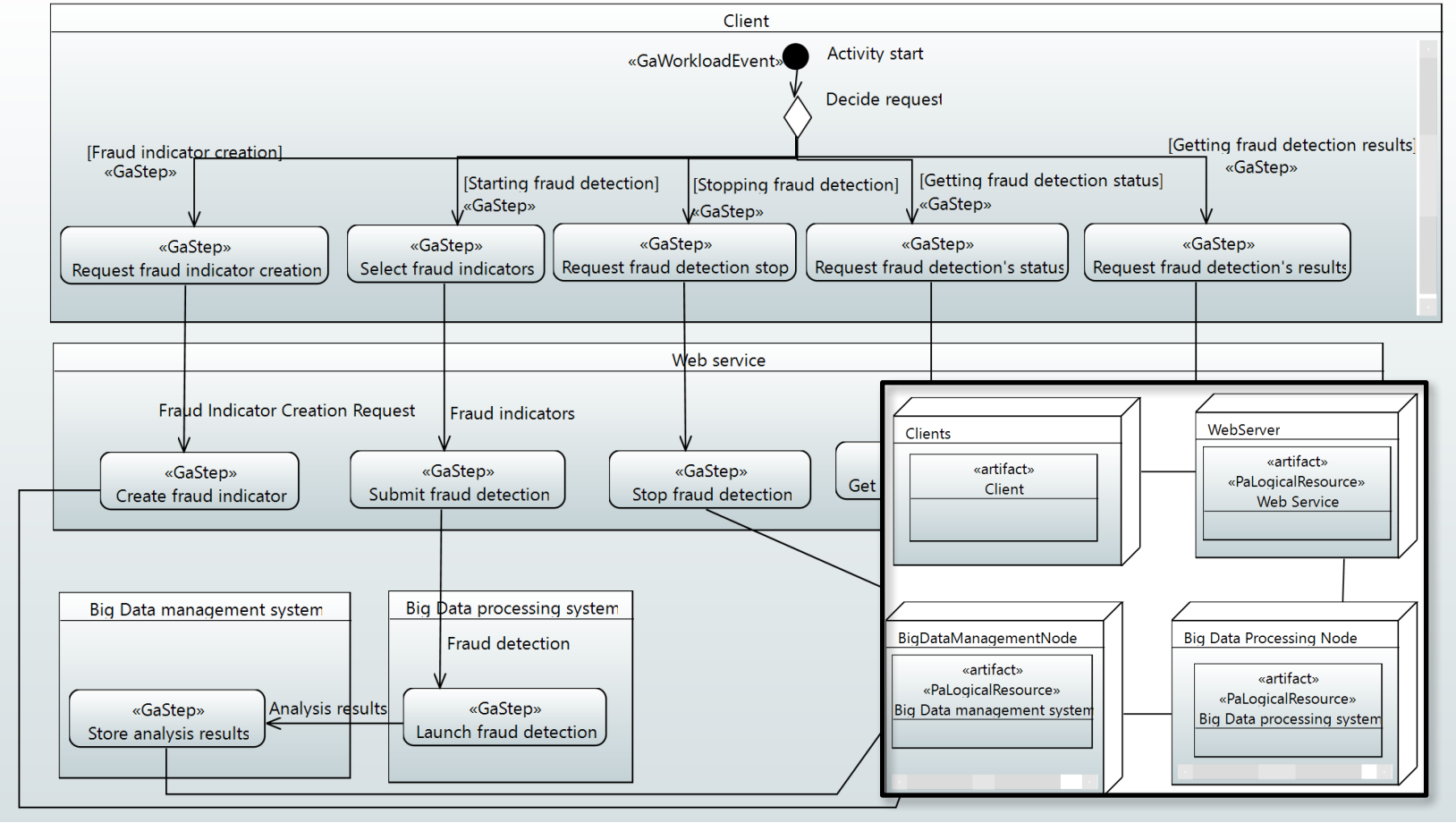

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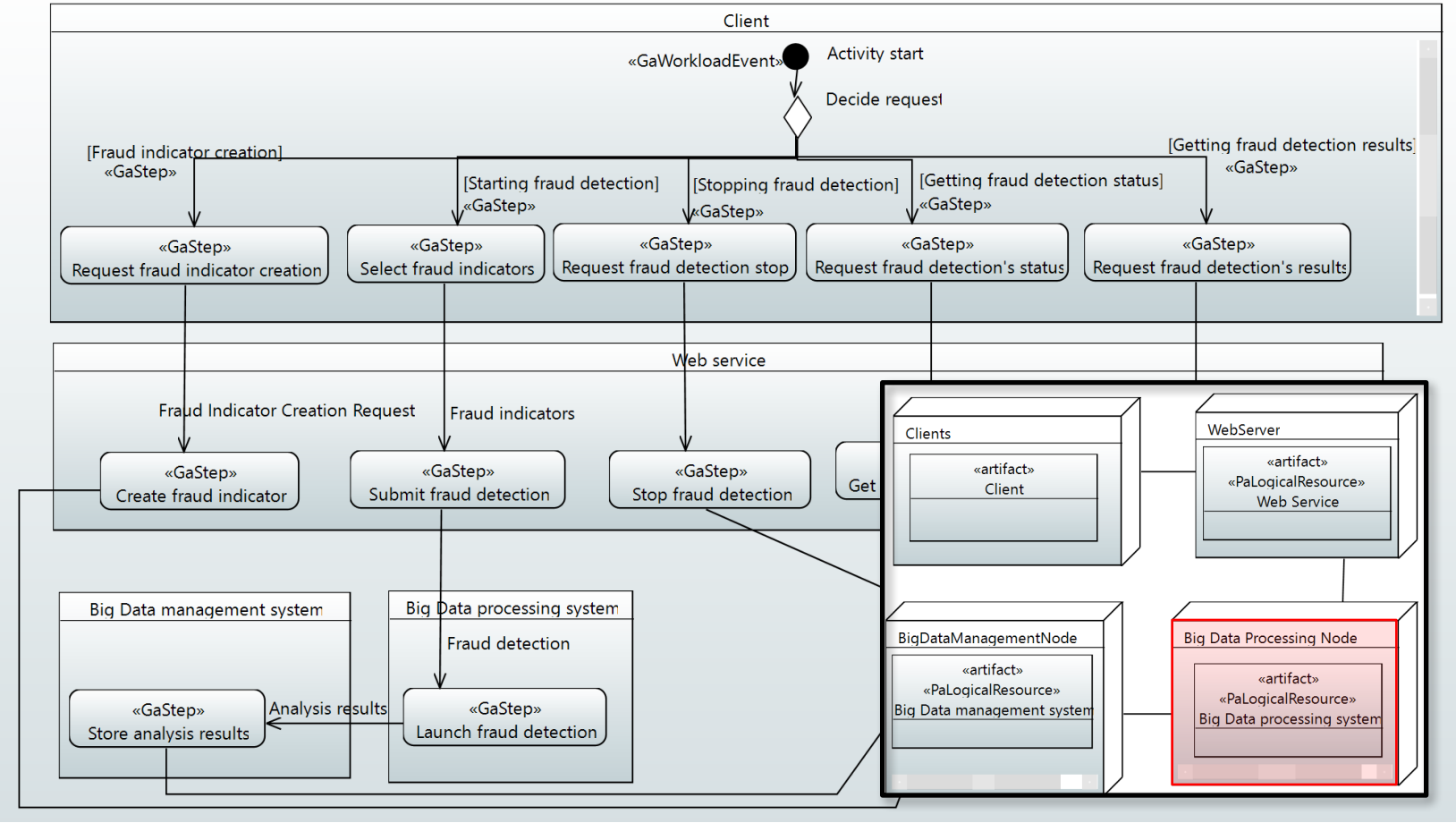

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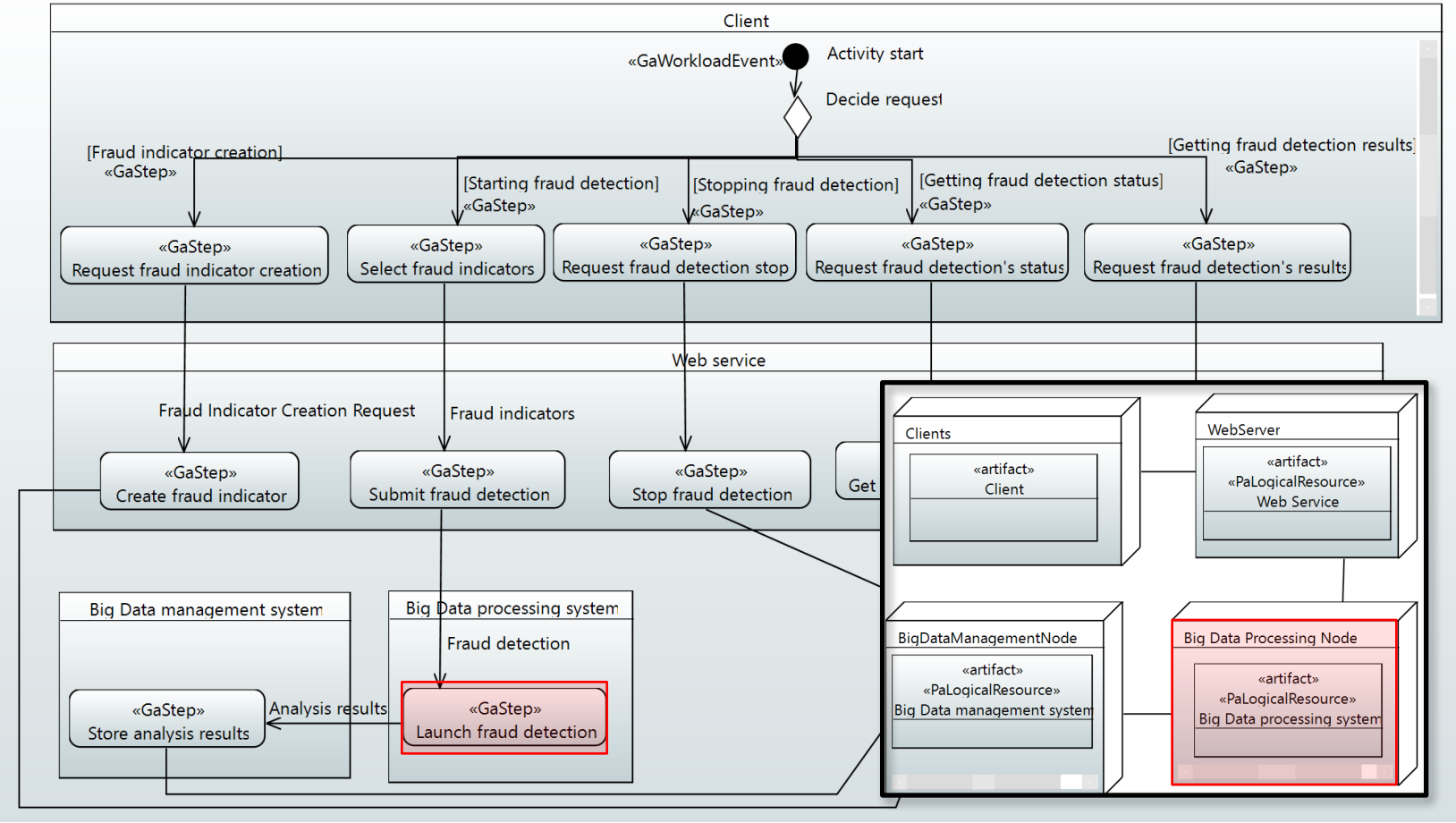

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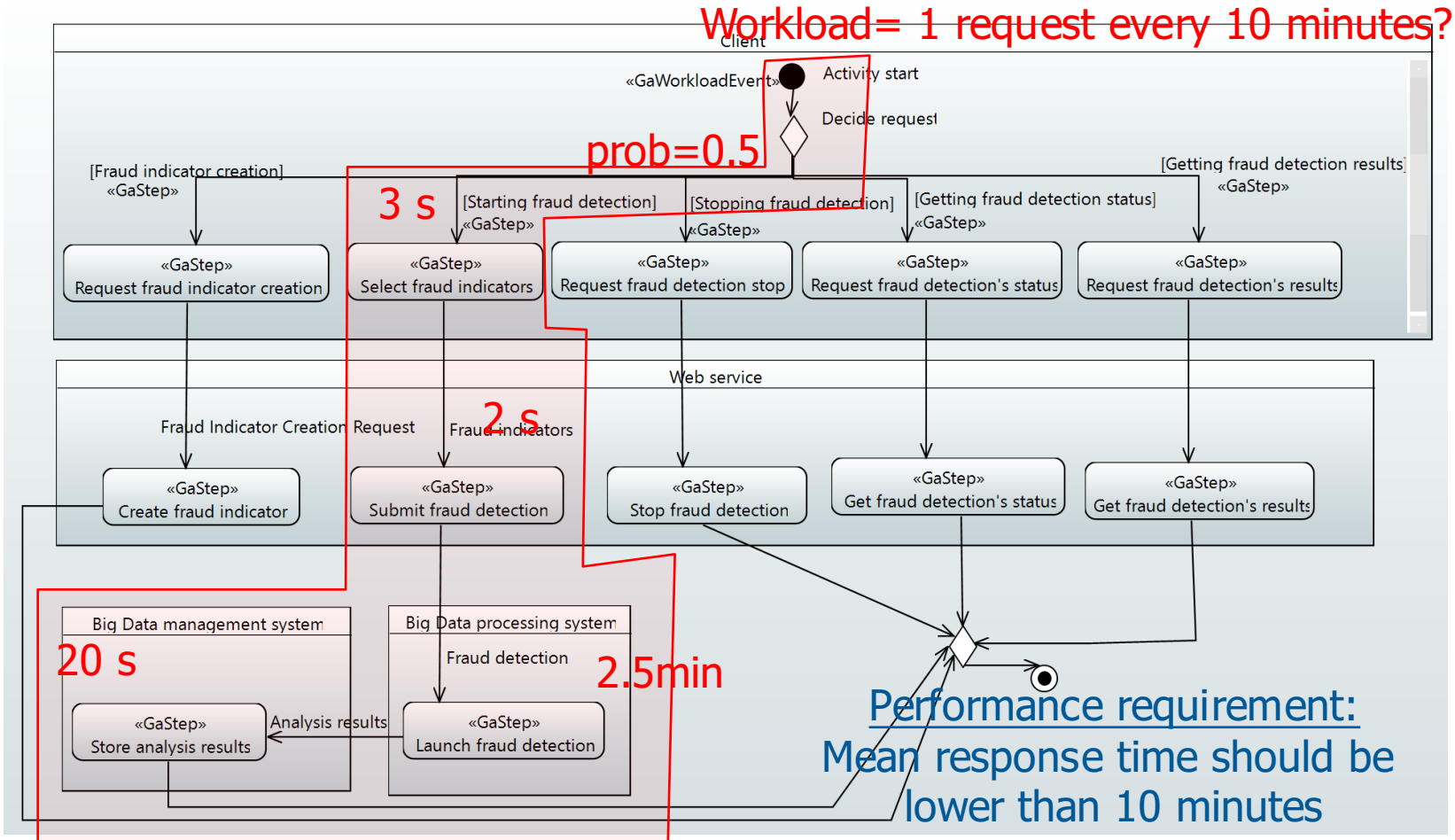

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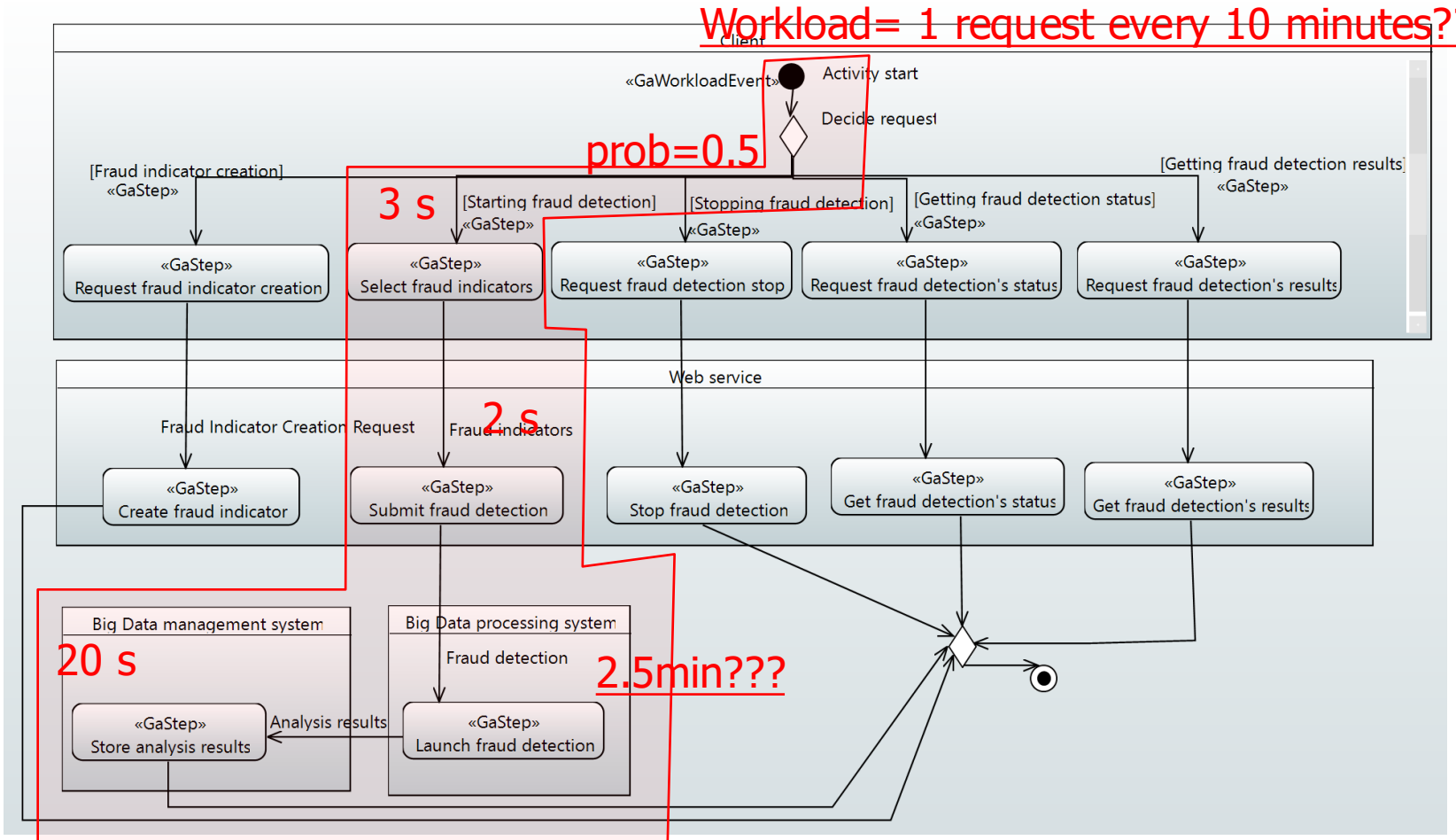

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- Quality malfunction reported
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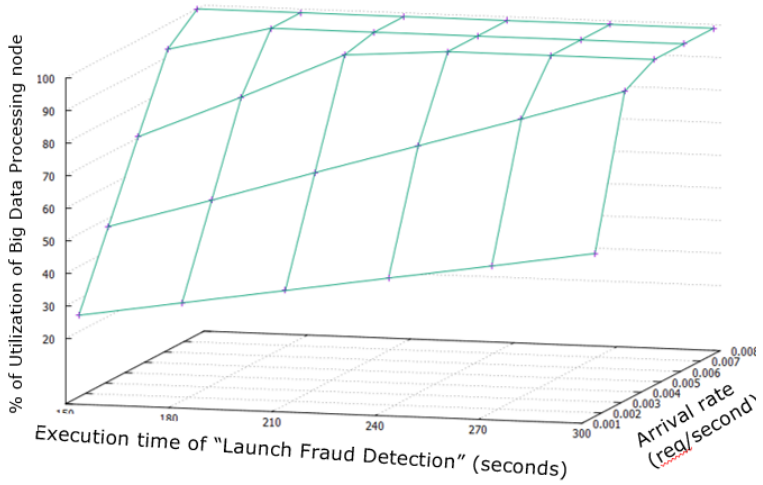


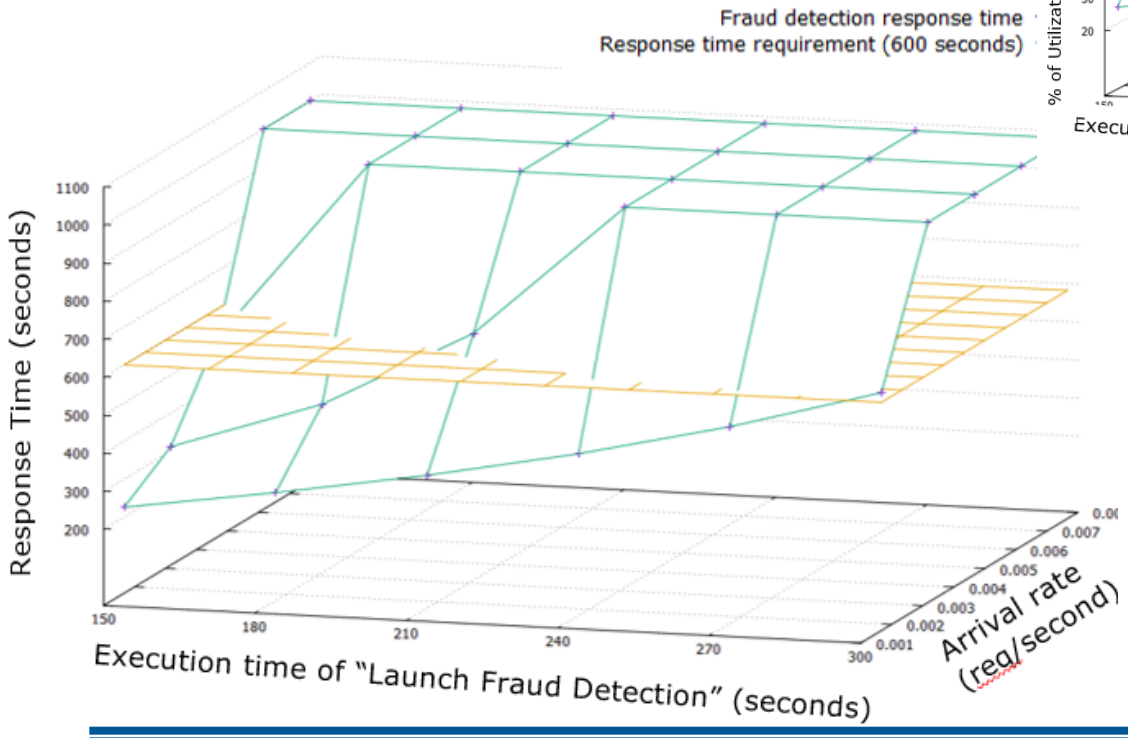

# Big Blu Quality assessment

- Quality malfunction reported
- Using the SimTool we obtain
- Developers see two possible solutions
  - Acquire more computing nodes for to parallelise requests
  - Reengineer *Launch Fraud Detection* activity to make it faster
- Using the SimTool we obtain

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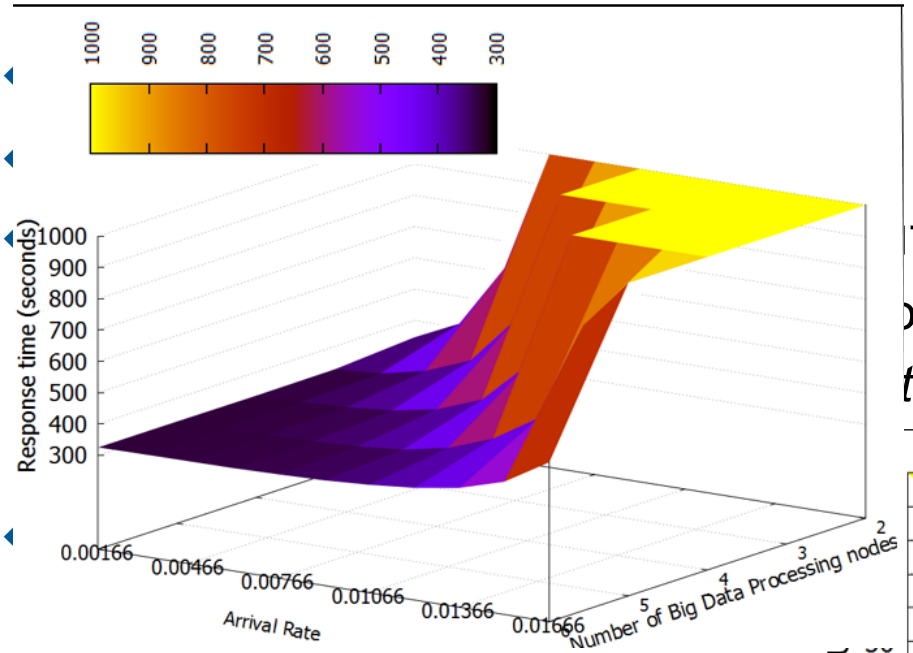


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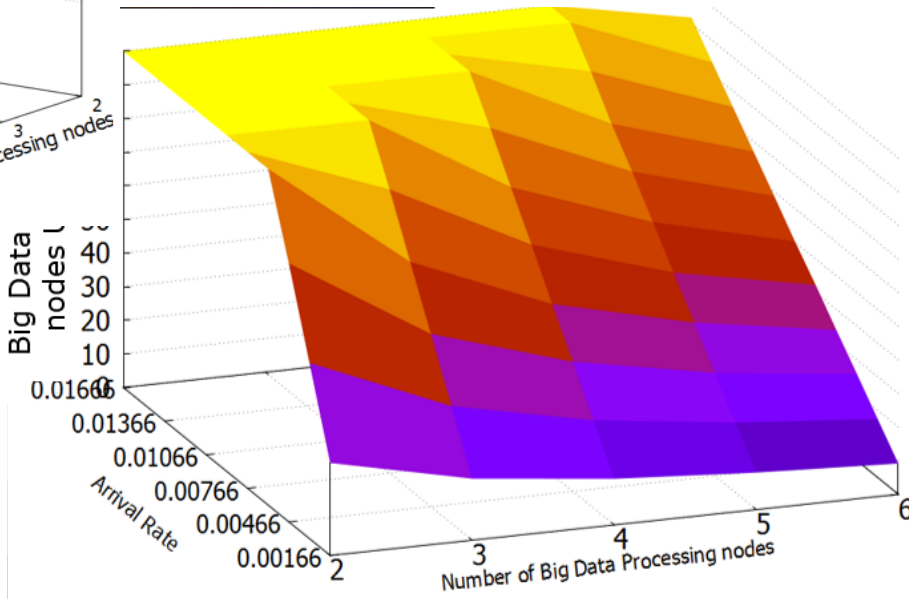

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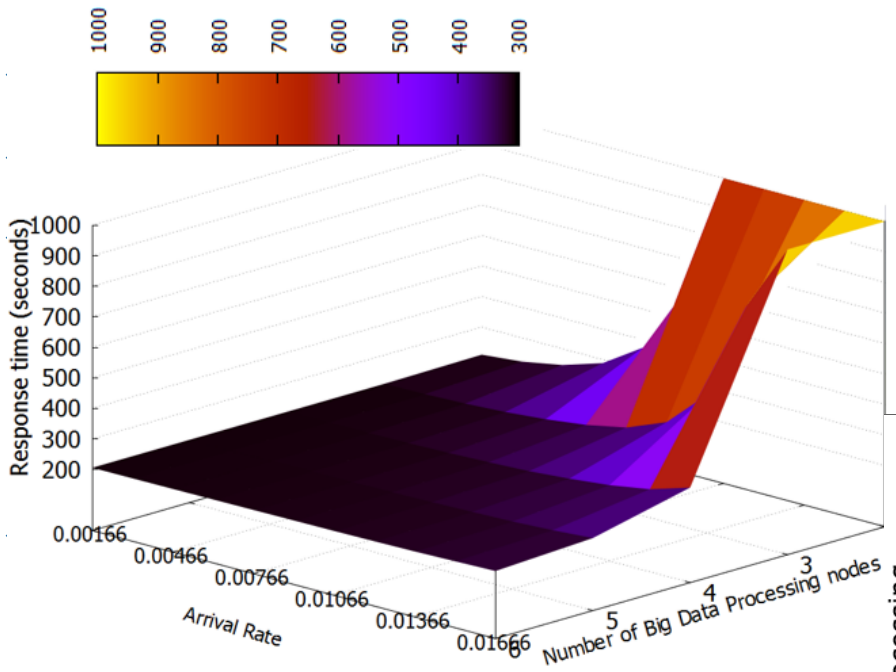


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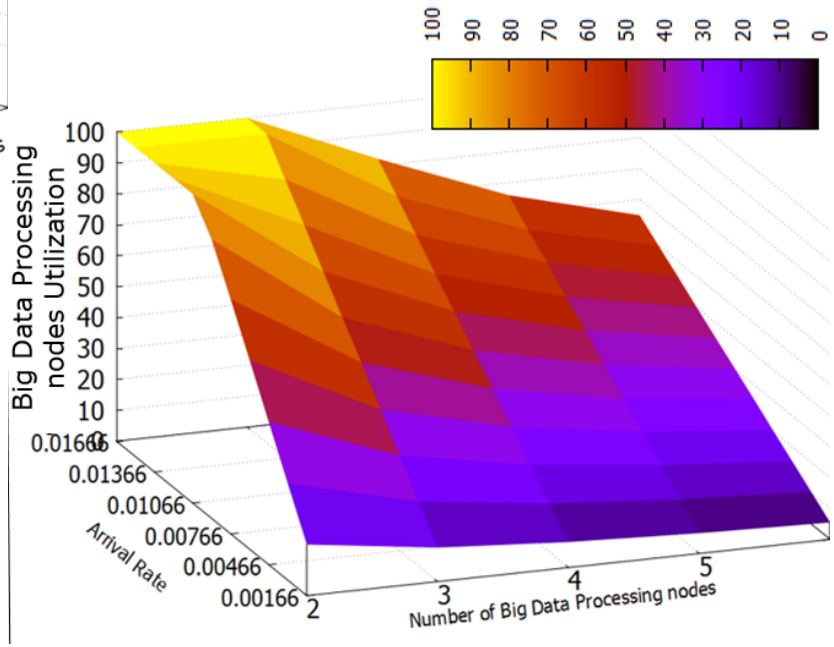

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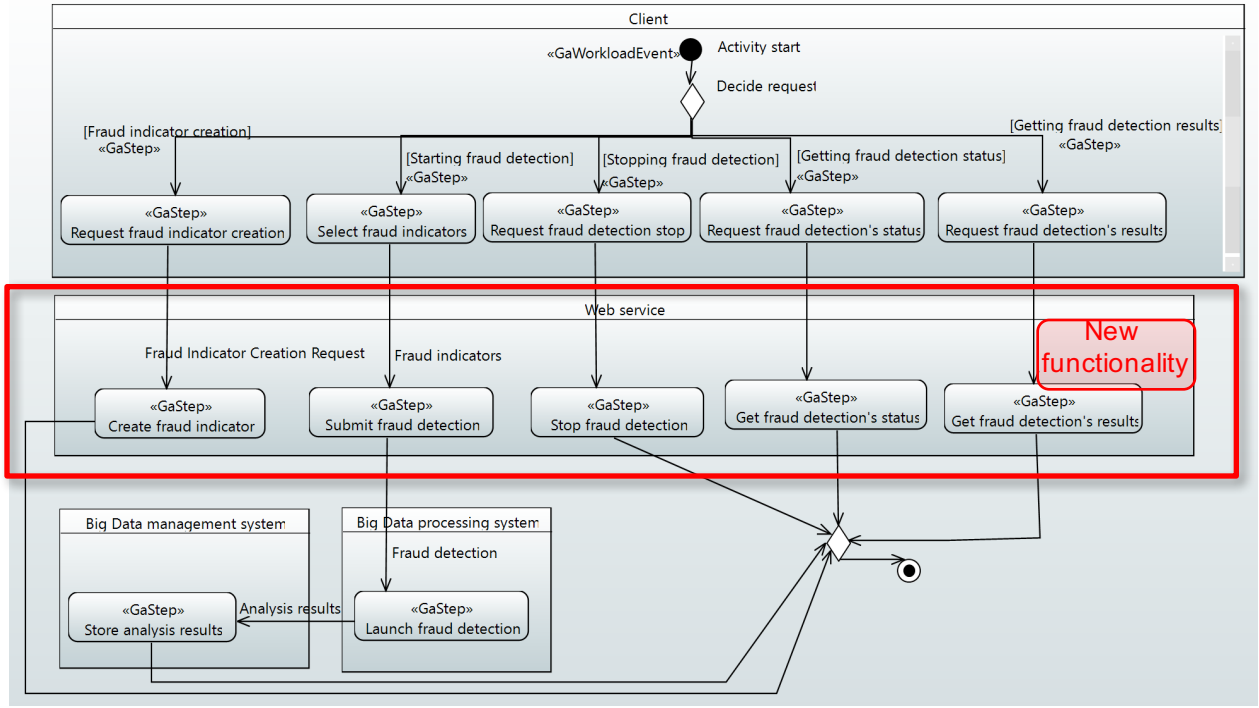

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  - Each of the current 200 clients will make 1 request per minute
  - Developers believe that they can make it to demand between 10 and 20 milliseconds for execution, but there are no new performance requirements

*"The mean mean response time of all paths should be less than 10 seconds, except for the 10 minutes allowed for Launch Fraud Detection path"*

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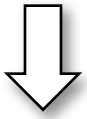
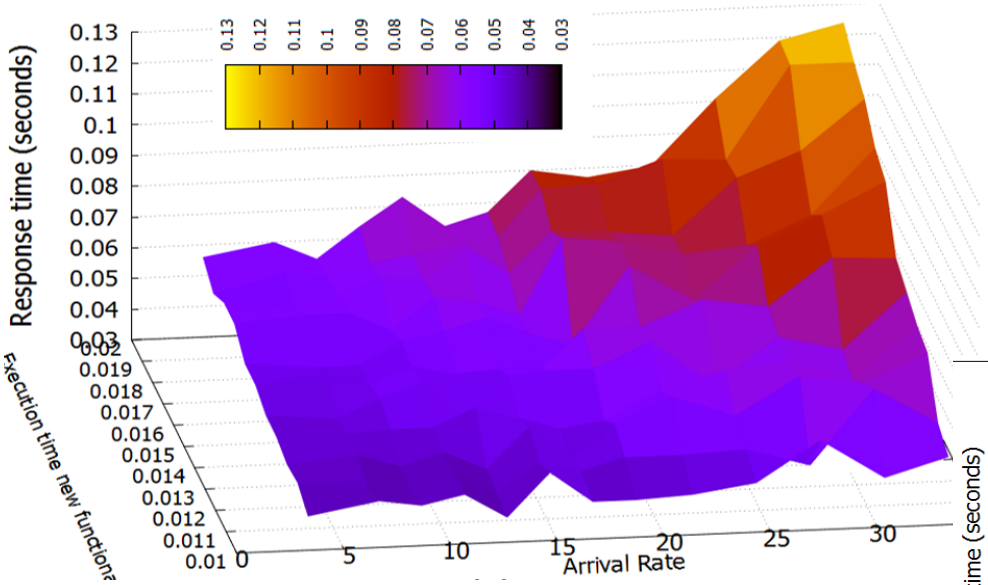
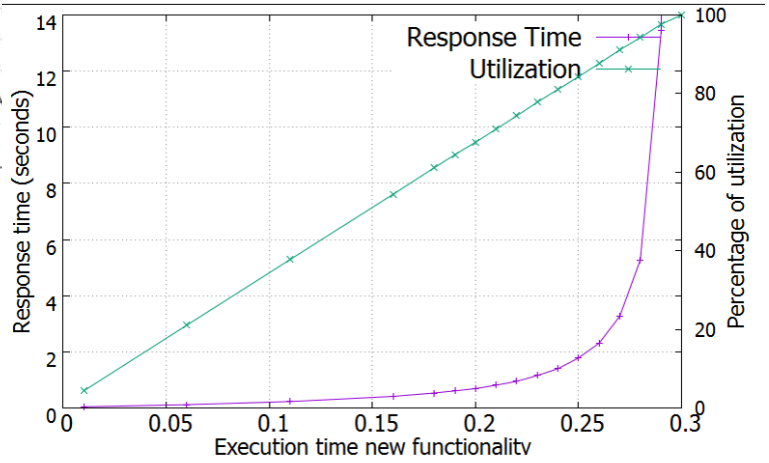


  - Developers do not know if their development will be good enough until integration or operation

# Big Blu Quality assessment

- Adding a new functionality
  - Using the SimTool we obtain



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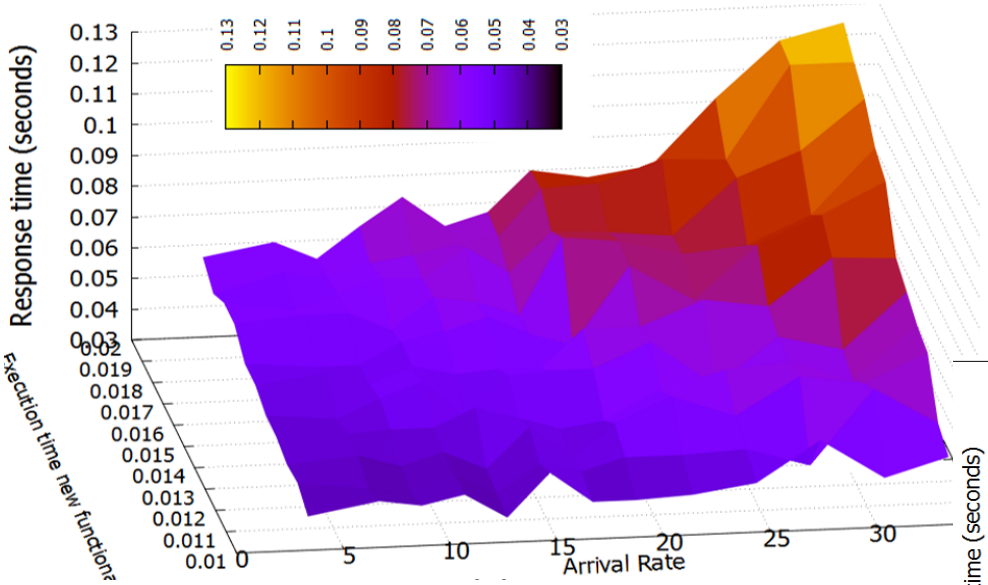
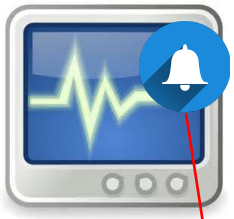
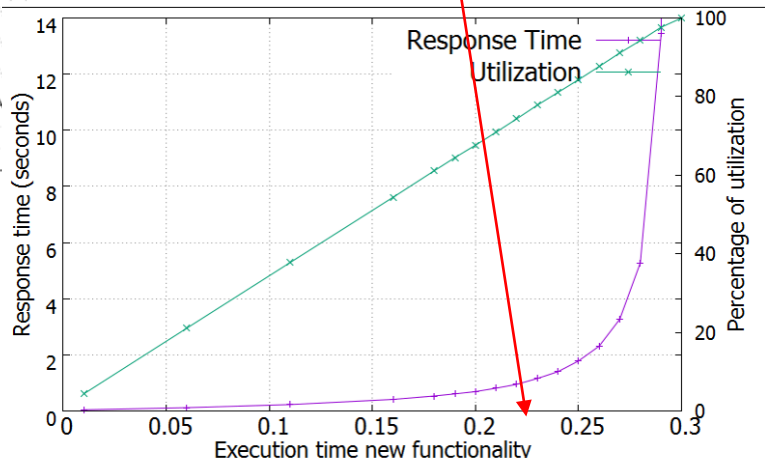




# Conclusions

- Report of an experience on usage of software quality evaluation during DevOps-oriented software development
- Reduce the number of development cycles until satisfactory modification of the system
- Reported two common scenarios in development cycles
  - Maintenance activity
  - Development of new functionality

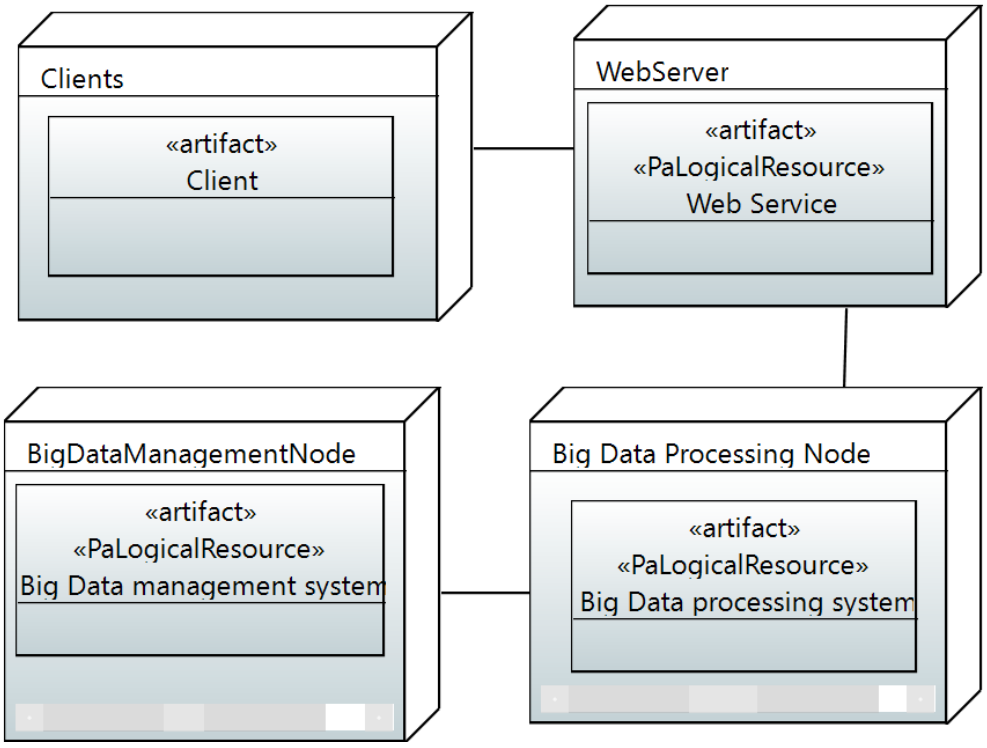
**FUTURE:**

- Big Blu uses Big Data technologies such as Apache Spark
- SimTool will incorporate characteristics of Big Data technologies

# Quality assessment in DevOps:

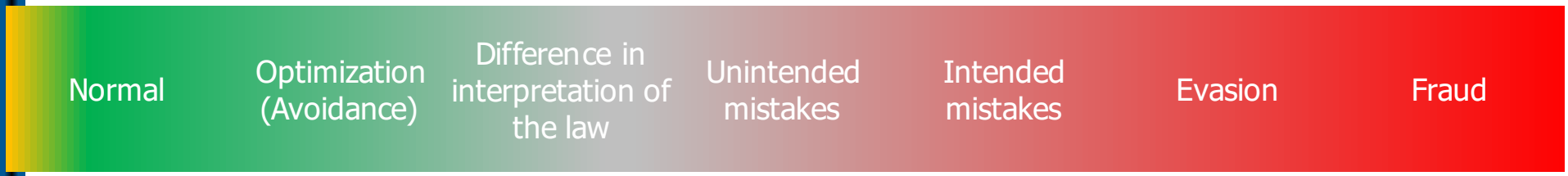
## Automated Analysis of a Tax Fraud Detection System

**THANK YOU FOR YOUR ATTENTION!**


Clients
«artifact»
Client
WebServer
«artifact»
«PaLogicalResource»
Web Service
BigDataManagementNode
«artifact»
«PaLogicalResource»
Big Data management system
Big Data Processing Node
«artifact»
«PaLogicalResource»
Big Data processing system

| **Probabilities.** *Prob. of...* | | **Workload** | |
|---|---|---|---|
| Fraud indicator creation | 0.11 | 1 request every 600s | |
| Starting fraud detection | 0.5 | **Resources.** *Num. of...* | |
| Stopping fraud detection | 0.02 | Web Server | 1 |
| Getting fraud detection status | 0.12 | Big Data Management | 1 |
| Getting fraud detection results | 0.25 | Big Data Processing | 1 |

| **Activities Service Times** | |
|---|---|
| Request fraud indicator creation | 2s |
| Select fraud indicators | 3s |
| Request fraud detection stop | 3s |
| Request fraud detection status | 1s |
| Request fraud detection results | 2s |
| Create fraud indicator | 3s |
| Submit fraud detection | 2s |
| Stop fraud detection | 1s |
| Get fraud detection's status | 0.1s |
| Get fraud detection's results | 3s |
| Store analysis results | 20s |
| Launch fraud detection | 150s |


Tax Compliance
Tax Non-compliance
Normal
Optimization (Avoidance)
Difference in interpretation of the law
Unintended mistakes
Intended mistakes
Evasion
Fraud

**Big Blu**

# Motivation

- DICE initiative. SimTool is part of it
- Netfective Technology is developing BIG BLU
- Big Blu - Performance effective
- Iterations of new and modified characteristics: Agile
- New developments may not be appropriate for Operations: DevOps
- Reduce the number of incorrect cycle iterations
- DevOps and Agile images here….

# DICE Simulation Tool

- A DB has... %A second typical usage scenario happens when an new Dev cycle starts and the \emph{quality improvement of a functionality} is planned, assigned to a developer, and monitored information from the Ops is received remarking the poor quality of the current system. This necessity of a new development may come from an inappropriate previous development of the functionality, but not necessarily. The necessity may also come because it happens that the usage of the system has exceeded initial expectations and has increased considerably since the initial development of the functionality. For instance, accesses to a database that has grown in content and concurrent utilization have created a performance bottleneck in the system. The developer can update the quality values in the design model with those ones coming from the monitoring of the application and execute the simulation tool to identify bottlenecks. By the \emph{what-if} analysis, the developer can hypothesize about different quality values several parts of the design in order to identify how much the quality of concrete parts of the system should improve in order to make the overall system satisfy again its requirements. The developer can also play the \emph{what-if} analysis with different designs. Following the previous example, the developer can evaluate what would happen if a cache is created that can resolve 60\% of accesses to the database in very little time.