The Need for unified Testbed Management across multiple Teams and Stakeholders in a large scale Telecom Integration Context

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AGENDA

- Introduction
- Project Context
- Problem Analysis
- Proposed Solution
- Experimental Results
- Conclusions and Further Work

INTRODUCTION

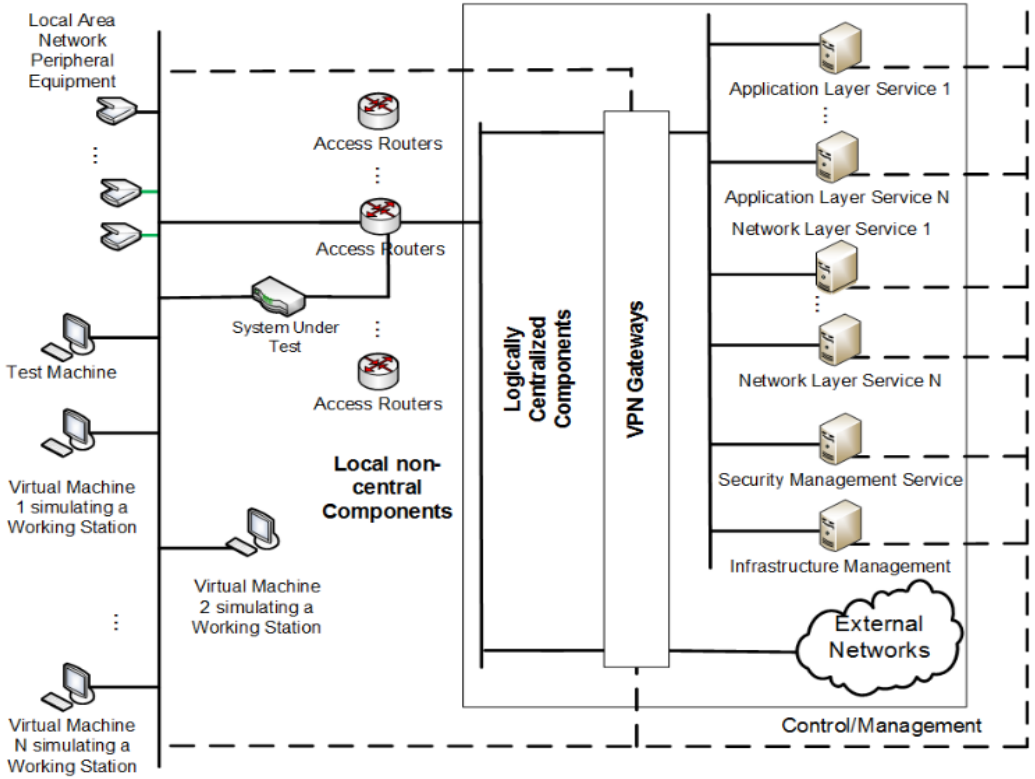
- Execution of different types of tests in industrial setups
  - Development tests – i.e. unit and module testing
  - Model-in-the-loop and hardware-in-the-loop testing by switching between simulations - on the interfaces of the SUT (System Under Test) - and real hardware (on the interfaces of the SUT) thereby detecting implementation errors on early stages
  - Product test - quality assurance/acceptance testing on top of the development test
  - Security testing – i.e. penetration and certification testing for national agencies
  - Component test of the integrator involving multiple teams with various capabilities
  - Integration and interoperability testing across the overall infrastructure

INTRODUCTION

- Multi-stakeholder approach in the testing sub-project of a large scale telecom project

- Identified problems
  - **the synchronization of the test environment (i.e. testbed artefacts/images) across multiple stakeholders**
  - **a way to efficiently manage, synchronize and distribute the testbed images across teams and workstations was required**
  - **Unified Testbed Management across Multiple Teams and Stakeholders in a large scale Telecom Integration Setup**

PROJECT CONTEXT



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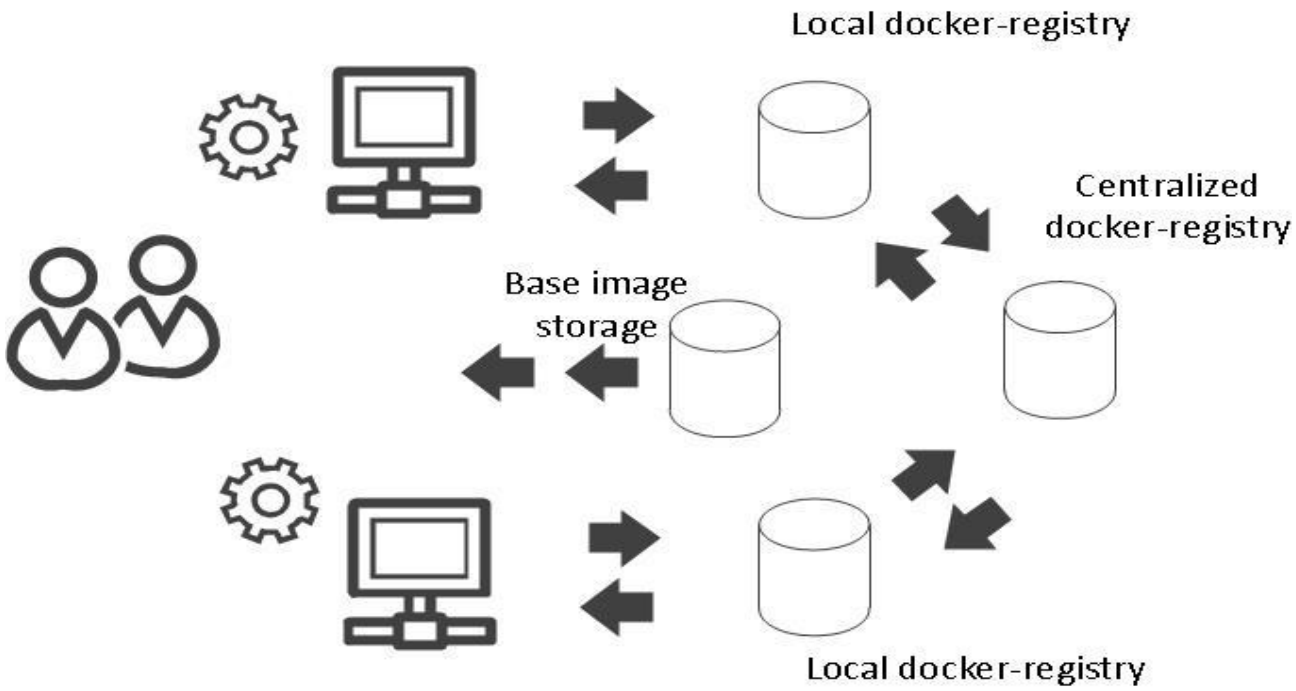
PROBLEM ANALYSIS

Issue/Risk	***Analysis/Description***	***Frequency***
No_info_on_changes	We very often encountered situations were changes were conducted on the tesbed virtual machines from within one of the involved test and development teams. Correspondingly these changes were not communicated to the other teams which led to a divergence of the used testbed versions across the various teams and stakeholders.	**very often**
Proprietary_testbed_configurations	The missing communication between the (often) competing teams has implied a large number of proprietary configurations which were extremely difficult to synchronize across the difficult teams and have led to a chaotic situation w.r.t. aspects such as test result reproducibility etc.	**very often**
Inefficient_ synchronization_on_specification_updates	The overall system specification has been occasionally changing (around two times per year) which required adaptations in the testbed environment. Provided the separation of the teams and the lack of a unified process, the adaptations were conducted in different ways, which has finally led to large proprietary deviations that could be traced back to conflicting interpretation of the specification changes.	**rare**

PROBLEM ANALYSIS

Issue/Risk	***Analysis/Description***	***Frequency***
Non_comparable_test_results	The proprietary and deviating testbed variations have led to test results which were not comparable across the various teams and stakeholders. This resulted in costly and time consuming discussions paired with corresponding debugging sessions.	**often**
Inefficient_handling_of_defects	All issues/risks described hitherto have led to a highly inefficient handling of failures and belonging tickets/defects. The failed test results in one team were very often not reproducible within the environment of the other teams, leading to costly and time consuming discussions and controversies regarding the interpretation of the specifications and the test results.	**very often**
Instabilities_in_testbed_handling	The differences in the testbed versions - even within the same team - have led to many instabilities and differences in the way the testbed components were handled within the test scripts. Some test scripts could only be executed on particular work stations and their results and execution flows were very different due to the testbed configuration chaos.	**often**
Incompatible_cryptographic_material	Another aspect of incompatibility having its origins within the testbed problems relates to the incompatible cryptographic material (certificates, Certificate Revocation Lists, DNSSEC keys …) across the different testbed versions. These cryptographic artefacts were diverging in various details such as the utilized cypher-suites, the certificate chains etc. In many cases this has led to incompatible diverging test results in different environments.	**rare**
False_positives	All the described differences have sometimes led to false positive test results in cases when a PASSED result got wrongly accepted in the overall discussion among the teams. In such situations, the responsible test team has wrongly configured its proprietary testbed based on a misunderstanding of the technology or the specification.	**rare**

PROPOSED SOLUTION



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PROPOSED SOLUTION

Issue/Risk	***Mitigation***	***Result***
No_info_on_changes	Based on the docker images and the established exchange infrastructure (gitlab, docker-registries …), changes to the belonging network and configurational setup were easily communicated between the team members and stakeholders.	solved
Proprietary_testbed_configurations	The testbed configurations were continuously synchronized across the different teams based on the docker-files and the centralized repositories accessible from within the various sites.	solved
Inefficient_synchronization_on_specification_updates	Testbed adaptations made upon changes to the system specifications were easily communicated and synchronized across the involved teams.	solved
Non_comparable_test_results	The difference in test results across the various test and development teams was solved with respect to the testbed configuration divergence, given the established exchange and synchronization infrastructure and the utilized docker artefacts for testbed management.	solved

PROPOSED SOLUTION

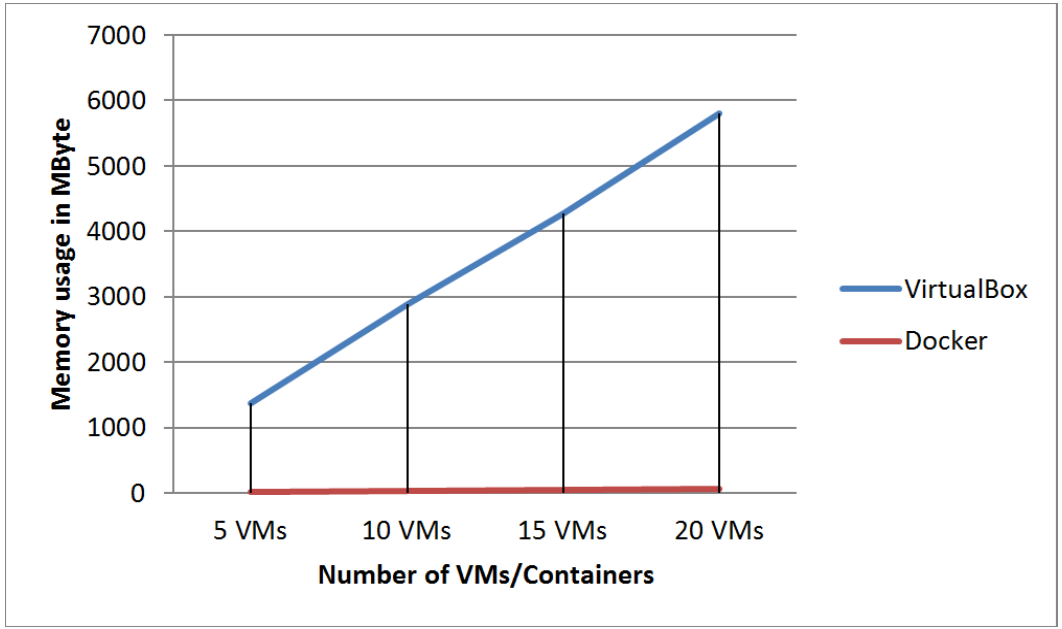
Issue/Risk	Mitigation	Result
Inefficient_handling_of_defects	The time for handling and processing of tickets/defects by the development teams was largely accelerated given the increased reproducibility of results across the various teams and stakeholders.	solved
Instabilities_in_testbed_handling	The instabilities in the test scripts, emerging from the divergent proprietary testbed configurations across various workstations, were intrinsically removed based on the proposed solution.	solved
Incompatible_cryptographic_material	The cryptographic material was unified within one centralized testbed instance that was collaboratively worked on across the various teams and partners.	solved
False_positives	The probability for a false positive result based on the divergent testbed configs and a misunderstanding of the technology or specification aspects was largely reduced provided the collaborative distributed approach based on gitlab *pull*, *push* and *merge* commands. Thereby, regular test and reviews of testbed changes were applied until proposed changes were approved and established across the involved teams as a basis for further testing.	solved

EXPERIMENTAL SETUP

- Restarting the overall testbed in order to increase the test execution stability

Modell	ThinkPad T470 Signature Edition
Processor	Intel (R) Core (TM) i5-7200U CPU@2.50GHz 2.71 GHz
RAM	24,0 GB (23,9 GB usable)
System type	64 Bit Operating System X64-based Processor

NUMERICAL RESULTS



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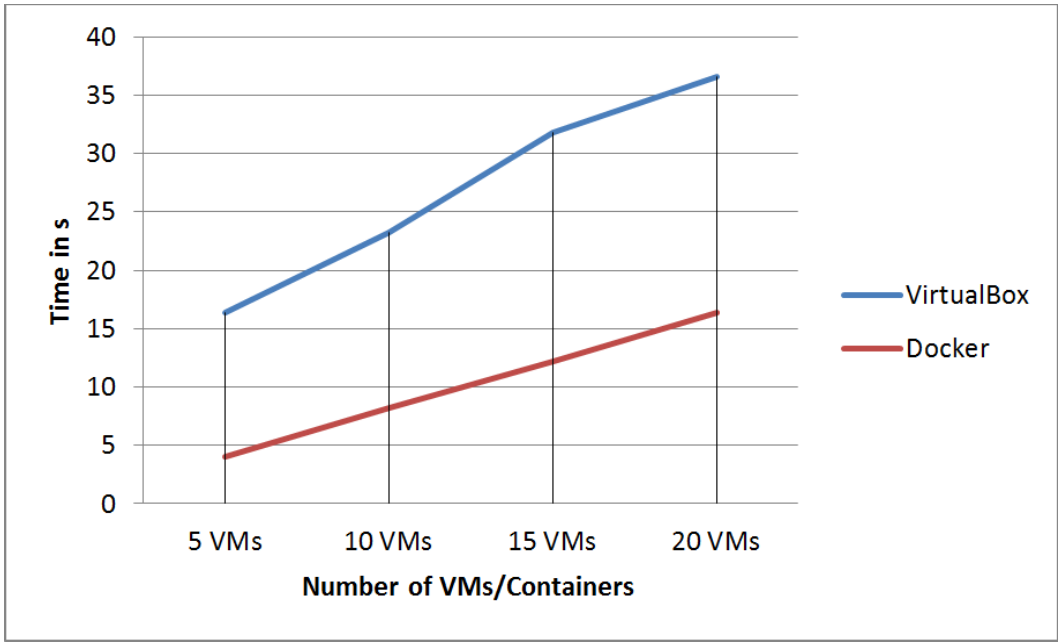
NUMERICAL RESULTS



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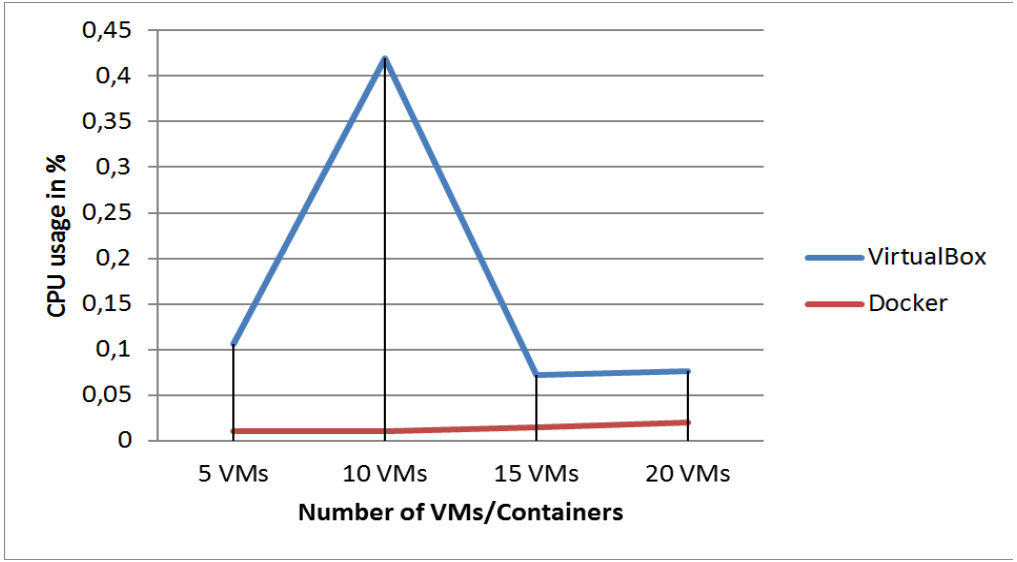
NUMERICAL RESULTS



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CONCLUSIONS AND FUTURE WORK

- Complex testing project involving a number of partners with conflicting goals
- Complicated situation with respect to testbed management
- Systematic analysis of the observed and identified issues
- Implemented solution based on the utilization of docker and version management system
- **The implemented solution helps resolve the identified issues**
- **The implemented solution improves the stability of the test execution and optimizes the ressource utilization on the testing workstations**

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