How TMMi supports the Three Ways of DevOps

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This paper is intended to help DevOps practitioners find out which TMMi process areas, goals and practices support DevOps practices. It shows how TMMi can support the implementation of DevOps principles by analyzing the "Three Ways of DevOps" in the context of TMMi. It will also help TMMi Professionals to understand the applicability of TMMi in a DevOps context.

Introduction

TMMi is a process maturity model for testing. TMMi contains stages or levels through which an organization passes as its testing process evolves from ad hoc test process to managed, defined, measured and optimized. The five levels in the TMMi prescribe a maturity hierarchy with an evolutionary path to test process improvement. Every maturity level, apart from level 1, contains three to five process areas, a cluster of related practices in an area that, when implemented collectively, satisfy a set of goals considered important for making significant improvement in that area. These goals are called specific goals and the specific goals are elaborated in specific practices, sub practices and typical work products. Apart from the specific goals and practices there are a set of generic goals and practices which are applicable for every process area. More information can be found at www.tmmi.org or in the appendix to this document.

In this section we describe how we as testing practitioners understand the Three Ways of DevOps [1]. Our understanding is that DevOps wants to change the software delivery practices and culture, and the underlying principle of TMMi (from defect detection to defect prevention) lends itself to that cultural change. We assume the reader is already accustomed with or using agile principles, and looking at DevOps for ways to further increase the rate of cultural change while ensuring quality is not an afterthought in your pipeline.

In this document we give TMMi based suggestions that can support the implementation of different aspects of the Three Ways of DevOps. That doesn't mean we think all organizations that use DevOps should implement all TMMi process areas, specific goals, generic practices and underlying specific practices, sub-practices and example work products. Organizations should assess what they need in their situation and use the suggestions in this document as ideas that might be worth considering to improve testing in the testing DevOps context. Organizations are recommended to critically choose and only do the practices from TMMi that matter and have added value. Whilst TMMi is comprehensive, to be successful organizations must identify the key testing practices and improvements requiring focus. Use the TMMi model based on your business drivers and use process areas, goals and practices that have the most value. As such, use TMMi in a more continuous mode to some extent, and don't use the maturity levels too strictly.

For additional context, please refer to the information in the references section that explains how an assessment or test process improvement can be conducted using the TMMi framework for agile delivery methods.

Mapping of TMMi goals to Three Ways of DevOps

DevOps practices can be generally placed into three principles, called the Three Ways of DevOps in the ground-breaking blog posts and books by Gene Kim et al [6]. We'll examine these ways that highlight what in a DevOps culture should happen against the goals and practices of TMMi to identify similarities

between these two models and highlight where each can benefit from one another. For more information on the three ways of DevOps see [2] and [7].

The First Way – Flow (Moving from Left to Right)

The First Way emphasizes the performance of the entire system, as opposed to the performance of a specific silo of work or department — this as can be as large a division (e.g., Development or IT Operations) or as small as an individual contributor (e.g., a developer or system administrator).

Shorten Lead Time

Lead time is the time taken from having the idea, to delivering the product or service to the customer (sometimes referred to as "Aha to Ker-ching"). Shortening Lead Times involves removing human obstacles and waste from the process where appropriate in order to increase flow efficiency [8], which essentially is the essence of TMMi maturity level 3 [6].

- In TMMi we can find different goals and practices that can help shorten lead time. Essentially only the parts of the application that are affected by development in terms of risks are tested. Test as little as needed but not less than that. Unnecessary testing, in terms of risks, is waste and makes the lead time longer. PA 2.2 Test Planning, SG 1 Perform Product Risk Assessment and SG 2 Establish a Test Approach help organization prevent testing too much (or too little). This thought is continued at maturity level 3 with PA 3.3 Test Lifecycle and Integration, SG 3 Establish a Master Test Plan and PA 3.4 Non-functional Testing, SG 1 Perform a Non-functional Product Risk Assessment.
- In DevOps, testing should be integrated in the DevOps lifecycle, to shorten the lead time. PA 3.3 Test Lifecycle and Integration, SG 2 Integrate the Test Lifecycle Models with the Development Models can help with this. In this specific goal the test lifecycle is integrated with the development lifecycle, DevOps in this case, to ensure early involvement and prevent the situation where testing is an activity after development.
- Applying quality measures early in the development activities also helps shortening the lead time. Early testing supports failing fast, which is in turn supported by PA3.5 Peer Review, SG2 Perform Peer Reviews where we conduct reviews before dynamic testing and analyse peer review results to identify problem areas at an early stage. The whole maturity level 4, beginning from PA 4.1 Test Measurement to PA 4.2 Product Quality Evaluation to PA 4.3 Advanced Peer Reviews support this process of shortening lead times, guiding organizations towards a higher maturity level.
- In both development and operations, the lack of availability and quality of test environment can be an obstacle and make lead times longer. Therefore, test environments need to be developed, implemented, managed and controlled in a mature way. PA 2.5 Test Environments can help DevOps team in achieving this.
- Finally, PA 4.2 Product Quality Evaluation significantly contributes towards the shortening of development and test cycles as quantifying the product quality goals leads to optimized test measurement techniques and therefore to an earlier identification of corrective actions.

System Thinking

System Thinking (in a DevOps context) is the analysis of all elements of the value stream (People, Process and Technology) as the "system" in order to gain a profound understanding of the system, enable the making of informed decisions and to identify and resolve issues.

- Systems should be designed and realized in a way to allow rapid change, therefore testing needs to be able to identify the risk of changes within the context of complete system. PA 2.1 Test Policy & Strategy, SG 1 Establish a Test Policy helps organizations with setting the test policy to align to the business goals and the need to demonstrate some level of systems thinking. It is the starting

point for ensuring that quality related activities are conducted to add value rather than satisfy a perceived need or contractual obligation. This is then used at PA 2.2 Test Planning, SG 2 Establish a Test Approach to ensure the context of the complete system is being considered during test planning.

- System thinking means that all elements are integrated along the complete test lifecycle. TMMi supports this by integrating the test process into the overall application lifecycle (PA 3.3 Test Lifecycle & Integration), meaning that the test process can be more easily measured and controlled as a part of the overall "system".
- System Thinking is a powerful mechanism for enabling the identification of opportunities to optimize the process. At Maturity Level 3, PA 3.1 Test Organization specifically calls out Test Process Improvements as part of SG 4 and SG 5, moreover at this level Generic Goal 3 Institutionalize a Defined Process is introduced, which covers continuous collection of improvement information on testing processes.
- Finally, PA 5.3 Test Process Optimisation can help organizations in the visualisation of work and mapping the value stream and therefore drive test process improvements across the whole system.

Increased Visibility

Making work visible is achieved through the use of practices like visual work boards (e.g. Kanban) and value stream mapping, helping to identify constraints and bottlenecks in the process and increase throughput [6].

- By defining a standard set of test processes (PA 3.3 Test Lifecycle and Integration, SG 1) to be followed across the organisation, all work that uses the process has higher visibility. This doesn't mean that the process needs to be stuck to rigidly. Deviations from the process - where justified - can be either identified as process improvement opportunities if they would benefit all teams or implemented in isolation in line with tailoring guidelines (see next bullet).
- Through the implementation of tailoring guidance (PA 3.3 Test Lifecycle & Integration), Agile teams can determine the suitability of process elements for the Releases and Sprints they need to deliver. This helps maintain a standardised, repeatable and measurable process that has wide enough boundaries to remain relevant. Where an element of the standard process is tailored consistently by all teams, it would indicate a process improvement opportunity and become part of the standard process, thereby demonstrating process optimisation and continuous improvement.
- By aligning the test process with the development process, teams will improve the coherency of quality activities and consistency of the test process throughout the lifecycle
- Through the use of retrospectives to optimize test processes as defined in PA 3.1 Test Organisation, SG 4 and SG 5 an organization can focus on removing constraints and bottlenecks. Taking this to the next level when undertaking Defect Prevention (PA 5.1 Defect Prevention) teams are looking to analyse the root cause of common defects and implement measures to prevent those defects occurring in the future
- Beginning with PA 3.1 Test Organization (SG 4 and SG 5) as well as the Generic Goal 2 introduced at this level and spanning to PA 5.3 Test Process Optimization, TMMi looks for organisations to introduce mechanisms that help to fine-tune and continuously improve the test process. The actions taken from Value Stream Mapping and similar activities directly support this Process Area

Just in Time process

Just In Time (JIT) has its origins in Lean manufacturing (Toyota TPS). In DevOps it is used to refer to managing and controlling (even limiting) flow through the process, reducing batch size and multitasking as much as possible in order to shorten lead times and maximise flow [6].

- The test strategy (PA 2.1 Test Policy and Strategy, SG 2) and corresponding test approach (PA 2.2 Test Planning, SG 2 Test Approach) in DevOps should be in line with the Just-In-Time principles. DevOps organizations should decide how and where items should be tested, as well as how and where (automated) regression tests should be done.
- To make Just in Time process possible it should be clear how test design and execution should be done, PA 2.4 Test Design and Execution can help with this. Special attention should be given to the question how tests can be automated (refer to SG 2 Perform Test Implementation for guidance on how to develop and prioritize test procedures) , who will automate the test cases and where in the process the automated tests will be executed.
- In order to optimize the just in time delivery regularly the team should analyse the current process and implement improvements. Refer to the comments under System Thinking and Increased Visibility for more details on continuous improvement in TMMi.

The Second Way - Feedback Loops (Moving from Right to Left)

Shorten Loops
Shortening feedback (and feedforward) loops results in higher agility. If we understand the impact of what we are doing faster, we are able to react quicker and either change, deliver more (feedback isn't always bad!)or do less (but the right things). In order to shorten loops we need to get info out of the process.

- In order to get information out of the process DevOps teams should have basic monitoring and control processes in place. PA 2.3 Test Monitoring and Control, SG 2 Monitor Product Quality against Plan and Expectations helps these teams with this. But these basic monitoring and control processes are not sufficient to understand the impact of what we are doing and react quicker. PA 4.1 Test Measurements can help DevOps teams to deepen the insight in the processes.
- On top of monitoring and control to get information and test measurement to objectively evaluate the effectiveness and efficiency of the test process, DevOps teams can use PA 5.2 Quality Control to measure quality in the intended production environment using statistical methods as early and fast as possible and then decide based on the feedback to test more extensively of deploy without extensive testing
- The loop can also be shortened by measuring the quality as early as possible. On top of some of the goals and practices of SG 3.5 Peer Reviews the practices of PA 4.3 Advanced Reviews, helps to do so. DevOps teams can use the SG's of this PA to enhance the test strategy and test approach by aligning the different development, operations and testing activities.
- This is also aided at Maturity Level 4 by following PA 4.2 Product Quality Evaluation, which at SG 1 established measurable product quality goals and at SG 2 quantifies and manages progress against these goals, thereby shortening loops on product quality to key stakeholders.

Find & Fix Defects Faster
Finding defects earlier in the lifecycle and the notion that defects fix costs rise exponentially the closer you get to production is a well-accepted practice. Through practices like Continuous Integration (CI) small, frequent changes can be made and tested, fixed and passed early in the lifecycle. Reducing Mean Time To Repair (MTTR) is one of the key metrics in DevOps. Whilst it's traditionally used in the context of measuring production failures, the same metric can be applied to - and is as important at – all lifecycle stages, therefore being covered conclusively in the Master Test Plan per PA 3.3 Test Lifecycle and Integration, SG 3.

- Finding and fixing defects faster starts with making good choices what to test and what not to test. PA 2.2 Test Planning, SG 1 Perform a Product Risk Assessment and SG 2 Establish a Test Approach

helps with this. Special attention must be paid to test automation in the delivery pipeline, test automation should be an integrated part of the test approach.

- The review related PA's, PA 3.5 Peer reviews and PA 4.3 Advanced Reviews, can also help teams to find and fix defects earlier. These process areas can be used early in de DevOps process, as well as a way to analyse the effect of changes already in production.
- A category of defects which are often found and fixed late in the development lifecycle are non-functionals. And testing non-functionals can be very complex as well as time consuming. The goals and practices of PA 3.4 Non-functional Testing can help DevOps teams to improve the capability to include non-functional testing in the team activities.
- The goals and practices in Test Planning, (Advanced) Peer Reviews and Non-Functional Testing are highly action oriented. On level 5 we also find practices that help teams prevent defect from occurring; PA 5.1 Defect Prevention. Based on the identification and analysis of common causes of defects DevOps teams can define actions to prevent similar defect from occurring in the future.

Embed Knowledge

"Swarming" around issues when they occur is another practice with its origins in manufacturing. Considering an issue as a constraint to the system flow, swarming to resolve the issue brings in multiple disciplines to help resolve the issue but also spread knowledge of the issue and the areas that would normally remain unaware (or unconcerned). See the way assembly lines in automotive companies are designed to stop the complete flow if one worker has an issue, and if done correctly with others swarming to his assistance instead of blaming him or her for the stoppage. This prevents the problem from progressing downstream and allows all workers to learn from these issues

Embedding roles in a cross-team culture (Developers, Operations, Testers and designers in one team) early in the cultural change helps team members to learn each other's practices, viewpoints and pain points, making it easier to break down the silos and adopt different working practices later.

- TMMi supports this practice of embedding knowledge within teams by promoting the monitoring of product quality throughout the lifecycle (PA 2.3 Test Monitoring and Control and Control, SG 2 Monitor Product Quality against Plan and Expectations) and bringing issues to closure. This could be achieved by establishing a test guild following agile practices, which is a possible implementation of a test organisation in an agile and DevOps context.
- In the Test Environment process area, SG 3 Manage and Control Test Environments describes management and control of test environments, which are often the source for stoppages of testing activities within projects. Here TMMi emphasizes the need for continuous monitoring and managing test environment incidents in a dedicated manner.
- For most DevOps teams it is important to have knowledge and skills on testing in the team. PA 3.2 Test Training Program can help organizations to develop the right knowledge and skills in order to embed the right knowledge and skills.

The Third Way - Continuous Experimentation and Learning (Whole Cycle)

Continually Experiment

Being able to integrate process or technology improvements into daily work is a key cornerstone of continuous improvement. Too often, people encounter a "brick wall of indifference" when it comes to suggestions for improvements for lack of change readiness or capacity to change. The enablement of individual knowledge creation which is then turned into team and organisational knowledge needs to be emphasized and actively promoted. Building a high-trust organisation where all participants are lifelong learners and innovation is actively encouraged. Deploying ongoing improvement initiatives that empower teams to promote successful improvements needs to be institutionalised as a continual and dynamic system of learning.

As lead times are shortened, it becomes easier (quicker and less costly) to experiment, which in turn are aimed at shortening lead times and reducing waste even more. Amplified feedback loops mean decision making on success or failure is quicker and more accurate which enables improvement.

- TMMi as a whole is centered around continuous learning and gradual maturity growth. There are several practices that support such a continuous learning and experimentation environment. GP3.2 Collect improvement information describes how improvement information should be continuously gathered to support future use and improvement of an organization's process assets.
- PA 3.1 Test Organization with both SG 4 Determine, Plan and Implement Test Process Improvements and SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned lay the foundation for structured process improvement and continuous learning. TMMi takes this concept a step further at Maturity Level 5 with PA 5.3 Test Process Optimization takes the measurable process performance from level 4 and turns it into improvement proposals that are selected for deployment. Turning this process into ideas and triggers for continuous experimentation prevents an organization from turning into a bureaucratic process monster or an organization where blame for failure of experiments characterizes the culture.
- Finally, within PA 3.2 Test Training Program, SG 1 Establish an Organizational Test Training Capability specifies how an organizational training capability aligns strategic and project training needs, focusing not only on testing-related topics but on broader areas of quality and process improvement.

Learn from Failure
Building the trust culture across the organisation is key to enabling successful learning from failure. Individuals and teams need to know that they will not be punished when they fail (because failure is an opportunity to learn).

There are many organizations who have seen failure as a key ingredient for success, for example Amazon, Netflix and Coca-Cola where the growth of their organization is aligned to driving innovation, empowering the workforce through continuous learning and conducting bolder experiments which naturally leads to more mistakes, disappointments and failures. Through these failures the organization learns, adapts and potentially creates new products or efficient ways of working. This principle is all about developing and fostering a culture where constant experimentation and learning is encouraged and where people acknowledge that the way to mastery is through repetition and practice. When it comes to operations, one of the best things to aim for is probably boredom. You want to have well established processes and practice so much that your operation activities become boring and predictable.

- As both unintentional and intentional failures are introduced to the system, analysis of impacts presents an opportunity to improve and learn from those failures. Intentional failures (e.g. chaos monkey) are used to build resilience in the system (see increase resilience) and improve knowledge. TMMi supports this practice of learn from failure through organizations continuously collecting data from the process, product and workforce with the aim of analyzing that data to identify efficiencies, sustain an ability to support management information needs, PA 4.1 Test Measurement (SG1 & SG2 – SP 1.2 Specify test measures) details test measure factors to consider.
- Having the ability to measure product quality early and to adapt the strategy and approach through peer reviews (static testing) and combining with dynamic testing is essential for keeping approach dynamic by selecting the most effective tests, PA 4.3 Advanced Reviews and SG 2 Measure Product Quality Early in the Lifecycle by Means of Peer Reviews defines a set of the review criteria based on the product quality goals.

- PA 5.1 Defect Prevention supports learning from failure by identifying and analyzing common causes of defects (established already at maturity level 2 in across the lifecycle and taking action to prevent similar defect from occurring in the future. SG1 Determine Common Causes of Defects defines a defect classification scheme (IEEE 1044) allowing an understanding of the frequency of a defect occurrence, the effort to fix the defect, estimation of the effort to prevent further defects from recurring, the rework costs and the extent of any negative impact on the process performance.
- PA 3.1 Test Organization SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned helps building the trust culture across the organization which is key to enabling successful learning from failure. Individuals and teams need to know that they will not be punished when they fail (because failure is an opportunity to learn)

Repeat & Practice

Repetition and practice embeds knowledge at the individual, team and organizational level to increase efficiencies and throughput through the elimination of waste. This is achieved through consistently learning and practicing and so repetition in learning and delivery leads to less waste while practicing leads to improvements and further understandings.

- PA 3.1 Test Organization SG 3 Establish Test Career Paths supports this practice of repeat and practice through the establishment of a test career path which enables the testing resource to improve their knowledge, develop and enhance their skills. Established career paths have a framework of training, learnings and outcomes which results in industrialized practices and outcomes.
- The organization test process is assessed regularly to identify improvements as described in PA 3.1 Test Organization SG4 Determine, Plan and Implement Test Process Improvements (SP 5.3 Incorporate lessons learned into organizational test process). Improvements permit focus on what is working well and what is not working so well which will lead to further improvements and practice.
- Organizations cannot stand still, they must adapt by continuously improving their existing processes and keeping up with technological advancements in test tools or test methods, TMMi PA 5.3 Test Process Optimization covers this. Also, the ability to standardize those existing processes is just the first steps before making them widely available throughout that organization so that test assets are reused.

Increase Resilience

The practice of intentionally introducing tension into the process such as failures (e.g. Game Days, Fault Injections etc.), learning from those failures and improving the system (People, Process or Technology - systems thinking). As a result, resiliency can be increased in production which reduces the likelihood of failure and maximises efficiencies in the process to deliver more value faster.

- TMMi supports this practice area by creating a non-functional product risk assessment and following a defined approach based on those identified risks. Lessons learnt play an important part along with expert interviews, checklists and workshops as shown in PA 3.4 Non-Functional Testing, specifically SP 1.1 Identify non-functional products risks.
- Not understanding the processes and the data wrapped within those processes can lead to an incorrect approach for measuring the effectiveness of the testing. Having a formalized PA 4.1 Test Measurement program enables the workforce etc. to be assessed supported by GP 2.9 that objectively evaluates the test measurement adherence.
- Using the data to statistically manage and control the test process using operational profiles and usage models of the product helps ensures predictable performance of that product along with

identifying defect earlier supports resilience, see PA 5.2 Quality Control SG1 Establish a Statistically Controlled Test Process.

Conclusion

The TMMi framework is not only relevant for organizations practicing or transitioning to DevOps since it is a process quality/maturity improvement model regardless of how methodology/development being followed. Within each of the 3-way DevOp areas the TMMi process areas, specific goals, generic practices and underlying specific practices, sub-practices and example work products can be applied. Thus, organizations that have implemented the three ways of DevOps in their entirety are likely to follow TMMi practices. As shown in our paper to Agile and TMMi, the latter can help industrialize and improve processes by putting the focus on quality, effectiveness and efficiency, which are underlying principles of all modern process models.

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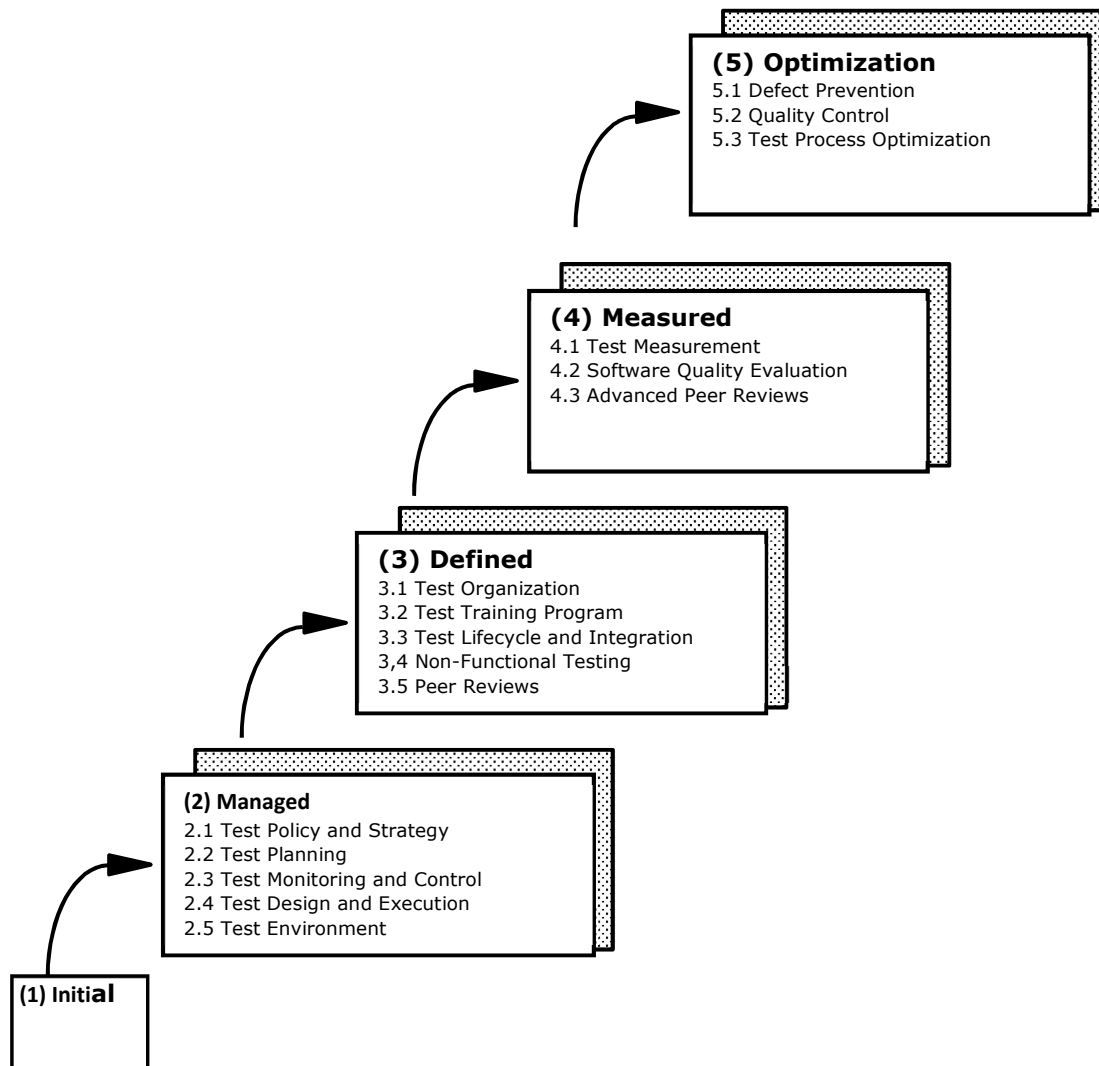
Reviewers

The following persons participated in the reviewing of this paper: Wei Gao (China), Mirco Hering (Australia), Tang Miao Miao (China), Meile Posthuma (Netherlands), Ella Shang (China), Erik van Veenendaal (Bonaire), Cui Zhe (China), and Guo Zhihua (China).

Appendix 1 - Introduction to TMMi

TMMi consists of sixteen process areas spanning four maturity levels. Each process area is defined by specific goals, which in turn can be fulfilled by a number of specific practices. Common to each process area are generic goals and practices.

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                                              ┌─────────────────────────────────┐
                                              │ (5) Optimization                │
                                              │ 5.1 Defect Prevention           │
                                              │ 5.2 Quality Control             │
                                              │ 5.3 Test Process Optimization   │
                                              └─────────────────────────────────┘
                               ┌─────────────────────────────────┐
                               │ (4) Measured                    │
                               │ 4.1 Test Measurement            │
                               │ 4.2 Software Quality Evaluation │
                               │ 4.3 Advanced Peer Reviews       │
                               └─────────────────────────────────┘
                ┌─────────────────────────────────┐
                │ (3) Defined                     │
                │ 3.1 Test Organization           │
                │ 3.2 Test Training Program       │
                │ 3.3 Test Lifecycle and Integration │
                │ 3,4 Non-Functional Testing      │
                │ 3.5 Peer Reviews                │
                └─────────────────────────────────┘
   ┌─────────────────────────────────┐
   │ (2) Managed                     │
   │ 2.1 Test Policy and Strategy    │
   │ 2.2 Test Planning               │
   │ 2.3 Test Monitoring and Control │
   │ 2.4 Test Design and Execution   │
   │ 2.5 Test Environment            │
   └─────────────────────────────────┘
┌──────────────┐
│ (1) Initial  │
│              │
└──────────────┘
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Process areas and specific goals

Maturity Level 2 - Managed

PA 2.1 Test Policy and Strategy

The purpose of the Test Policy and Strategy process area is to develop and establish a test policy, and an organization-wide or program-wide test strategy in which the test levels are unambiguously defined. To measure test performance, test performance indicators are introduced.

> SG 1 Establish a Test Policy
> SG 2 Establish a Test Strategy
> SG 3 Establish Test Performance Indicators

PA 2.2 Test Planning

The purpose of Test Planning is to define a test approach based on the identified risks and the defined test strategy, and to establish and maintain well-founded plans for performing and managing the testing activities.

SG 1 Perform a Product Risk Assessment

SG 2 Establish a Test Approach

SG 3 Establish Test Estimates

SG 4 Develop a Test Plan

SG 5 Obtain Commitment to the Test Plan

PA 2.3 Test Monitoring and Control

The purpose of Test Monitoring and Control is to provide an understanding of test progress and product quality so that appropriate corrective actions can be taken when test progress deviates significantly from plan or product quality deviates significantly from expectations.

SG 1 Monitor Test Progress against Plan

SG 2 Monitor Product Quality against Plan and Expectations

SG 3 Manage Corrective Actions to Closure

PA 2.4 Test Design and Execution

The purpose of Test Design and Execution is to improve the test process capability during test design and execution by establishing test design specifications, using test design techniques, performing a structured test execution process and managing test incidents to closure.

SG 1 Perform Test Analysis and Design using Test Design Techniques

SG 2 Perform Test Implementation

SG 3 Perform Test Execution

SG 4 Manage Test Incidents to Closure

PA 2.5 Test Environment

The purpose of Test Environment is to establish and maintain an adequate environment, including test data, in which it is possible to execute the tests in a manageable and repeatable way.

SG 1 Develop Test Environment Requirements

SG 2 Perform Test Environment Implementation

SG 3 Manage and Control Test Environments

Maturity Level 3 - Defined

PA 3.1 Test Organization

The purpose of the Test Organization process area is to identify and organize a group of highly skilled people that is responsible for testing. In addition to testing, the test group also manages improvements to the organization's test process and test process assets based on a thorough understanding of the strengths and weaknesses of the organization's current test process and test process assets.

SG 1 Establish a Test Organization

SG 2 Establish Test Functions for Test Specialists

SG 3 Establish Test Career Paths

SG 4 Determine, Plan and Implement Test Process Improvements

SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned

PA 3.2 Test Training Program

The purpose of the Test Training Program process area is to develop a training program which facilitates the development of the knowledge and skills of people so that test tasks and roles can be performed effectively and efficiently.

SG 1 Establish an Organizational Test Training Capability

SG 2 Provide Necessary Test Training

PA 3.3 Test Lifecycle and Integration

The purpose of Test Lifecycle and Integration is to establish and maintain a usable set of organizational test process assets (e.g., a standard test lifecycle) and work environment standards and to integrate and synchronize the test lifecycle with the development lifecycle. The integrated lifecycle ensures early involvement of testing in a project. The purpose of Test Lifecycle and Integration is also to define a coherent test approach across multiple test levels, based on the identified risks and the defined test strategy, and to provide an overall test plan, based on the defined test lifecycle.

> SG 1 Establish Organizational Test Process Assets
> SG 2 Integrate the Test Lifecycle Models with the Development Models
> SG 3 Establish a Master Test Plan

PA 3.4 Non-Functional Testing

The purpose of the Non-Functional Testing process area is to improve test process capability to include non-functional testing during test planning, test design and execution. This is done by defining a test approach based on the identified non-functional product risks, establishing non-functional test specifications and executing a structured test execution process focused on non-functional testing.

> SG 1 Perform a Non-Functional Product Risk Assessment
> SG 2 Establish a Non-Functional Test Approach
> SG 3 Perform Non-Functional Test Analysis and Design
> SG 4 Perform Non-Functional Test Implementation
> SG 5 Perform Non-Functional Test Execution

PA 3.5 Peer Reviews

The purpose of the Peer Review process area is to verify that work products meet their specified requirements and to remove defects from selected work products early and efficiently. An important corollary effect is to develop a better understanding of the work products and of defects that might be prevented.

> SG 1 Establish a Peer Review Approach
> SG 2 Perform Peer Reviews

Maturity Level 4 - Measured

PA 4.1 Test Measurement

The purpose of Test Measurement is to identify, collect, analyze and apply measurements to support an organization in objectively evaluating the effectiveness and efficiency of the test process, the productivity of its testing staff, the resulting product quality and the results of test improvement. As such, the test organization will develop and sustain a test measurement capability that is used to support management information needs.

> SG 1 Align Test Measurement and Analysis Activities
> SG 2 Provide Test Measurement Results

PA 4.2 Product Quality Evaluation

The purpose of Product Quality Evaluation is to develop a quantitative understanding of the quality of the products and thereby support the achievement of specific projects' product quality goals.

> SG 1 Measurable Project Goals for Product Quality and their Priorities are Established
> SG 2 Actual Progress toward Achieving the Project's Product Quality Goals is Quantified and Managed

PA 4.3 Advanced Reviews

The purpose of Advanced Reviews, building on the practices of the TMMi level 3 process area Peer Reviews, is to measure product quality early in the lifecycle and to enhance the test strategy and test approach by aligning peer reviews (static testing) with dynamic testing.

> SG 1 Coordinate the Peer Review Approach with the Dynamic Test Approach
> SG 2 Measure Product Quality Early in the Lifecycle by Means of Peer Reviews
> SG 3 Adjust the Test Approach Based on Review Results Early in the Lifecycle

Maturity Level 5 - Optimized

PA 5.1 Defect Prevention

The purpose of Defect Prevention is to identify and analyze common causes of defects across the development lifecycle and define actions to prevent similar defects from occurring in the future.

> SG1 Determine Common Causes of Defects
> SG2 Prioritize and Define Actions to Systematically Eliminate Root Causes of Defects

PA 5.2 Quality Control

The purpose of Quality Control is to statistically manage and control the test process. Test process performance is fully predictable and stabilized with acceptable limits. Testing at a project level is performed using statistical methods based on representative samples in order to predict product quality and make testing more efficient.

> SG1 Establish a Statistically Controlled Test Process
> SG2 Testing is Performed using Statistical Methods

PA 5.3 Test Process Optimization

The purpose of Test Process Optimization is to continuously improve the existing testing processes used in the organization and to identify new testing technologies (e.g., test tools or test methods) that may be appropriate and to transition them into the organization in an orderly manner. Test process improvement also supports the re-use of test assets across the organization. The improvements support the organization's quality and process performance objectives as derived from the organization's business objectives.

> SG1 Select Test Process Improvements
> SG2 New Testing Technologies are Evaluated to Determine their Impact on the Testing Process
> SG3 Deploy Test Improvements
> SG4 Establish Re-use of High Quality Test Assets

Generic goals

GG 2   Institutionalize a Managed Process

A managed process is a process that accomplishes the work necessary to produce work products, is planned and executed in accordance with policy, utilizes skilled employees with adequate resources to produce controlled outputs, involves relevant stakeholders, is monitored, controlled and reviewed, and is evaluated for adherence to its process descriptions. The process may be instantiated by a project, group, or organizational unit. The control provided by a managed process helps to ensure that the established process is retained during times of stress.

GG 3   Institutionalize a Defined Process

A defined process is a managed process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines. A defined process has maintained process descriptions and contributes work products, measures, and other process improvement information to the organizational process assets.

A critical distinction between a managed process and a defined process is the scope of application of the process descriptions, standards, and procedures. For a managed process, descriptions, standards, and procedures are applicable to a particular project, group, or organizational function. As a result, the managed processes of two projects in one organization may be different. A defined process is standardized as much as possible across the organization and is adapted only when required for a specific project or organizational function based on the published tailoring guidelines.

Appendix 2 – Mapping of DevOps ways to TMMi components

This appendix shows the combination of the aspects of the three ways of DevOps and the TMMi Process Areas (PA), specific goals (SG), generic goals (GG) and generic practices (GP) as elaborated in this technical paper. However, this is not an exhaustive list of TMMi components that support all aspects of the three DevOps ways. Those TMMi component that support DevOps can be different in a different context. In general it is best to analyze which TMMi component supports your DevOps implementation.

The First Way – Flow (Moving from Left to Right)

DevOps practices	TMMi Process Area (and Specific Goal)
Shorten Lead Time	PA 2.2 Test Planning, SG 1 Perform Product Risk Assessment
	PA 2.2 Test Planning, SG 2 Establish a Test Approach
	PA 2.2 Test Planning, SG 3 Establish a Master Test Plan
	PA 2.5 Test Environments
	PA 3.4 Non-functional Testing, SG 1 Perform a Non-functional Product Risk Assessment
	PA 3.3 Test Lifecycle and Integration, SG 2 Integrate the Test Lifecycle Models
	PA 3.5 Peer Review, SG 2 Perform Peer Reviews
	PA 4.1 Test Measurement
	PA 4.2 Product Quality Evaluation
	PA 4.3 Advanced Peer Reviews
System Thinking	PA 2.1 Policy & Strategy, SG 1 Establish a Test Policy
	PA 2.2 Test Planning, SG 2 Establish a Test Approach
	PA 3.3 Test Lifecycle & Integration
	PA 3.1 Test Organization SG 4 Determine, Plan and Implement Test Process Improvements
	PA 3.1 Test Organization SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned
	GG 3 Institutionalize a Defined Process
	PA 5.3 Test Process Optimization
Increased Visibility	PA 3.1 Test Organization, SG 4 Determine, Plan and Implement Test Process Improvements
	PA 3.1 Test Organization, SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned
	PA 3.3 Test Lifecycle and Integration, SG 1 Establish Organizational Test Process Assets
	PA 3.3 Test Lifecycle & Integration
	GG 2 Institutionalize a Managed Process
	PA 5.3 Test Process Optimization
Just in Time process	PA 2.1 Test Policy and Strategy, SG 2 Establish a Test Strategy
	PA 2.2 Test Planning, SG 2 Test Approach
	PA 2.4 Test Design and Execution
	PA 2.4 Test Design and Execution, SG 2 Perform Test Implementation

The Second Way - Feedback Loops (Moving from Right to Left)

DevOps practices	TMMi Process Area (and Specific Goal)
Shorten Loops	PA 2.3 Test Monitoring and Control, SG 2 Monitor Product Quality against Plan and Expectations

DevOps practices	TMMi Process Area (and Specific Goal)
Shorten Loops	PA 3.5 Peer Reviews
	PA 4.1 Test Measurements
	PA 4.2 Product Quality Evaluation, SG 1 Project Goals for Product Quality and their Priorities are Established
	PA 4.2 Product Quality Evaluation, SG 2 Actual Progress toward Achieving the Project's Product Quality Goals is Quantified and Managed
	PA 4.3 Advanced Reviews
	PA 5.2 Quality Control
Find & Fix Defects Faster	PA 2.2 Test Planning, SG 1 Perform a Product Risk Assessment
	PA 2.2 Test Planning, SG 2 Establish a Test Approach
	PA 3.4 Non-functional Testing
	PA 3.5 Peer reviews
	PA 4.3 Advanced Reviews
	PA 5.1 Defect Prevention
Embed Knowledge	PA 2.3 Test Monitoring and Control and Control, SG 2 Monitor Product Quality against Plan and Expectations
	PA 2.5 Test Environment, SG 3 Manage and Control Test Environments
	PA 3.2 Test Training Program

The Third Way - Continuous Experimentation and Learning (Whole Cycle)

DevOps practices	TMMi Process Area (and Specific Goal)
Continually Experiment	GP 3.2 Collect improvement information
	PA 3.1 Test Organization SG 4 Determine, Plan and Implement Test Process Improvements
	PA 3.1 Test Organization SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned
	PA 3.2 Test Training Program, SG 1 Establish an Organizational Test Training Capability
	PA 5.3 Test Process Optimization
Learn from Failure	PA 3.1 Test Organization SG 5 Deploy the Organizational Test Process and Incorporate Lessons Learned
	PA 4.1 Test Measurement SG 1 Align Test Measurement and Analysis Activities
	PA 4.1 Test Measurement SG 2 Provide Test Measurement Results
	PA 4.3 Advanced Reviews, SG 2 Measure Product Quality Early in the Lifecycle by Means of Peer Reviews
	PA 5.1 Defect Prevention, SG 1 Determine Common Causes of Defects
Repeat & Practice	PA 3.1 Test Organization SG 3 Establish Test Career Paths
	PA 3.1 Test Organization SG 4 Determine, Plan and Implement Test Process Improvements
	PA 5.3 Test Process Optimization
Increase Resilience	PA 3.4 Non-Functional
	PA 4.1 Test Measurement
	PA 5.2 Quality Control SG 1 Establish a Statistically Controlled Test Process