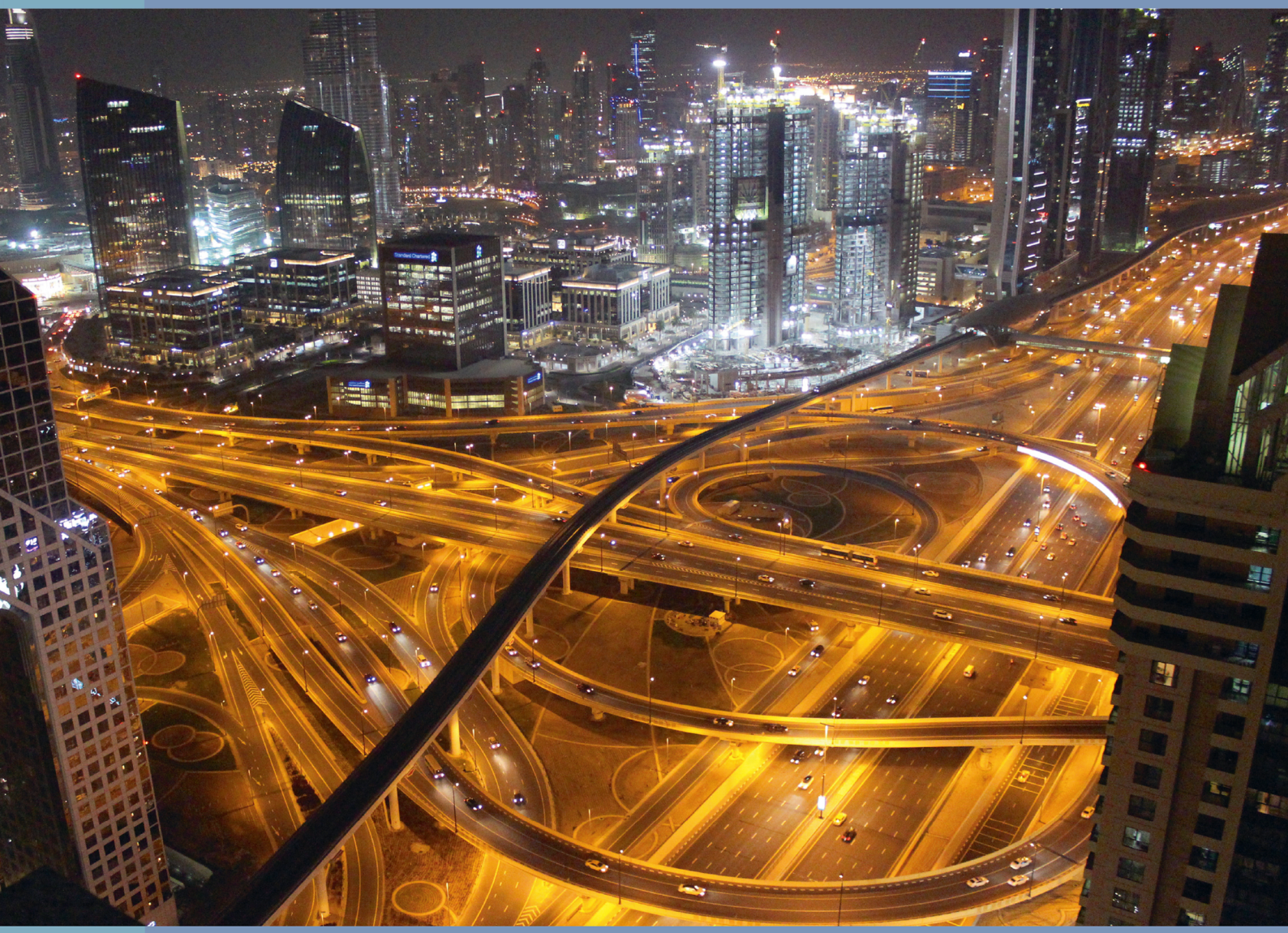
SOFTWARE TESTING AND TOOLING COURSEWARE

BASED ON CTAP



Rob Flier

Van Haren PUBLISHING

Software Testing and Tooling
Courseware
-
Based on CTAP

Colophon

Title:	Software Testing and Tooling Courseware - Based on CTAP
Authors:	Rob Flier
Publisher:	Van Haren Publishing, ‘s-Hertogenbosch
ISBN Hard Copy:	978 94 018 1282 5
Edition:	First edition, first print, February 2025
Design:	Van Haren Publishing, ‘s-Hertogenbosch
Copyright:	© Van Haren Publishing 2025

For further information about Van Haren Publishing please e-mail us at: info@vanharen.net
or visit our website: www.vanharen.net

Publisher about the Courseware

The Courseware was created by experts from the industry who served as the author(s) for this publication. The input for the material is based on existing publications and the experience and expertise of the author(s). The material has been revised by trainers who also have experience working with the material. Close attention was also paid to the key learning points to ensure what needs to be mastered.

The objective of the courseware is to provide maximum support to the trainer and to the student, during his or her training. The material has a modular structure and according to the author(s) has the highest success rate should the student opt for examination. The Courseware is also accredited for this reason, wherever applicable.

In order to satisfy the requirements for accreditation the material must meet certain quality standards. The structure, the use of certain terms, diagrams and references are all part of this accreditation. Additionally, the material must be made available to each student in order to obtain full accreditation. To optimally support the trainer and the participant of the training assignments, practice exams and results are provided with the material.

Direct reference to advised literature is also regularly covered in the sheets so that students can find additional information concerning a particular topic. The decision to leave out notes pages from the Courseware was to encourage students to take notes throughout the material.

Although the courseware is complete, the possibility that the trainer deviates from the structure of the sheets or chooses to not refer to all the sheets or commands does exist. The student always has the possibility to cover these topics and go through them on their own time. It is recommended to follow the structure of the courseware and publications for maximum exam preparation.

The courseware and the recommended literature are the perfect combination to learn and understand the theory.

-- Van Haren Publishing

Other publications by Van Haren Publishing

Van Haren Publishing (VHP) specializes in titles on Best Practices, methods and standards within four domains:

- IT and IT Management
- Architecture (Enterprise and IT)
- Business Management and
- Project Management

Van Haren Publishing is also publishing on behalf of leading organizations and companies: ASLBiSL Foundation, BRMI, CA, Centre Henri Tudor, Gaming Works, IACCM, IAOP, IFDC, Innovation Value Institute, IPMA-NL, ITSqc, NAF, KNVI, PMI-NL, PON, The Open Group, The SOX Institute.

Topics are (per domain):

IT and IT Management

ABC of ICT
ASL®
CATS CM®
CMMI®
COBIT®
e-CF
ISO/IEC 20000
ISO/IEC 27001/27002
ISPL
IT4IT®
IT-CMF™
IT Service CMM
ITIL®
MOF
MSF
SABSA
SAF
SIAM™
TRIM
VeriSM™

Enterprise Architecture

ArchiMate®
GEA®
Novius Architectuur
Methode
TOGAF®

Business Management

BABOK® Guide
BiSL® and BiSL® Next
BRMBOK™
BTF
EFQM
eSCM
IACCM
ISA-95
ISO 9000/9001
OPBOK
SixSigma
SOX
SqEME®

Project Management

A4-Projectmanagement
DSDM/Atern
ICB / NCB
ISO 21500
MINCE®
M_o_R®
MSP®
P3O®
PMBOK® Guide
Praxis®
PRINCE2®

For the latest information on VHP publications, visit our website: www.vanharen.net.

Table of content

Self-Reflection of understanding Diagram

'*What you do not measure, you cannot control*.'' – Tom Peters

Fill in this diagram to self-evaluate your understanding of the material. This is an evaluation of how well you know the material and how well you understand it. In order to pass the exam successfully you should be aiming to reach the higher end of Level 3. If you really want to become a pro, then you should be aiming for Level 4. Your overall level of understanding will naturally follow the learning curve. So, it's important to keep track of where you are at each point of the training and address any areas of difficulty.

Based on where you are within the Self-Reflection of Understanding diagram you can evaluate the progress of your own training.

Level of Understanding	*Before Training (Pre-knowledge)*	*Training Part 1 (1st Half)*	*Training Part 2 (2nd Half)*	*After studying / reading the book*	*After exercises and the Practice exam*
Level 4 *I can explain the content and apply it .*					
Level 3 *I get it!* *I am right where I am supposed to be.*					Ready for the exam!
Level 2 *I almost have it but could use more practice.*					
Level 1 *I am learning but don't quite get it yet.*					

(Self-Reflection of Understanding Diagram)

Write down the problem areas that you are still having difficulty with so that you can consolidate them yourself, or with your trainer. After you have had a look at these, then you should evaluate to see if you now have a better understanding of where you actually are on the learning curve.

Troubleshooting

Problem areas:	*Topic:*
Part 1	
Part 2	
You have gone through the book and studied.	
You have answered the questions and done the practice exam.	

Agenda

Day 1

Testtool overview
- What is test automation (a goal in itself)?

Working with tools for the
- Graphical User Interface
- Programming Interface

Testtool selection
- Tool adoption
- Tool selection

Working with:
- Graphical User Interface
- Robot Framework

Day 2

Test roles

Continuous testing

Working with
- Robot Framework
- Cypress
- BrowserStack

Syllabus

Certified Test Automation Professional (CTAP)

Foundation

Version 1.0

Index

Description

This syllabus describes the Certified Test Automation Professional (CTAP) Foundation Level Certification requirements, learning objectives and related information to prepare for the CTAP Foundation exam.

Need for standardized approach in test automation

Professionals and organizations are becoming increasingly dependent on IT, which raises questions about the quality of software.

The speed at which software is developed today makes manual testing obsolete. It's not easy to keep the pace up. The speed of development and releases is important in an Agile/DevOps environment. The concepts of Continuous Integration and Continuous Delivery (CI/CD) are commonplace nowadays. Continuous testing is a need of CI/CD, where test automation plays a key role.

In this scenario, test automation extends beyond simply automating regression tests. Test automation must be implemented across the entire development process. This requires that tests must be administered as quickly as possible and, preferably, automatically.

Test automation is one of the first things that is implemented within Agile teams. However, knowledge and expertise are frequently restricted to one team or project and are difficult to transfer to other teams or projects.

An overly technical approach is frequently suggested, with the main focus on tools and too little attention paid to people, organizations, data and processes. This makes it difficult to scale and transfer best practices within an organization.

The goal is to set up test automation in a way that will be beneficial in the future so that other members of the organization can take advantage of it. Extra attention is required for the creation of test automation that is reusable, expandable, and transferable in such a manner that inside the organization a reliable quality level of test automation is attained.

This demands more attention to detail and a focus on transferability and knowledge sharing, but it also affects how specific test situations and test scripts are created.

Certified Test Automation Professionals and organizations benefit from:

- Increased quality of test automation;
- Reusability of test automation;
- Ability to leverage industry best practice from a vast number of professionals over many years;
- Availability of a common language within your team and organization in relation to test automation;
- Guaranteed quality levels of a test automation engineer.

About the CTAP consortium

The CTAP consortium is a non-for-profit collaboration of industry experts, consultancy organizations, end users, trainers and academics. All these participants believe that the automation of testing involves common approaches that should always be followed, regardless of a professional's background, type of tooling used and industry.

CTAP stands for Certified Test Automation Professional. The shared ambition of the consortium members and its founders is to ensure that professionals who are active within the testing domain have been certified in CTAP, and therefore can benefit from a common understanding of best practice in test automation. The aim is to also ensure a proper execution, enabling higher quality software and reusability of test automation. The Foundation level is the first level which is completed. Applying the CTAP accreditation will guarantee an assured quality level of test automation engineers.

The CTAP consortium has set out three main activity areas through which to achieve this goal:

1. Auditing the supported Test Automation Certification and trainer accreditation program.
2. Promoting the adoption of test automation in public and private organizations.
3. Facilitating access to test automation learning materials and certification for individuals who want to increase their employability.

The Certification Council is an independent panel of test automation and certification experts, each representing different industries and interests. Council members are selected from member organizations of the CTAP consortium based on their experience, network and contributions to test automation.

The Council provides advice on content-related matters and is responsible for auditing the Test Automation Certification based on market standards.

The ambition of the CTAP consortium is to:

"Create a common understanding of the level of expertise required for managing test automation."

Practical information

You must pass a multiple-choice exam in which your knowledge of test automation will be assessed to obtain the CTAP certificate.

All exam candidates will get access to the online exam environment and will need to answer 40 multiple-choice questions within 60 minutes.

You must answer 65% of the questions correctly (or at least 39 of the 60 questions) in order to pass. Each question usually has four possible answers and only one of these is the best answer.

You will receive the result immediately after the exam. (Digital) Access to your certificate will be given once you have passed.

Registration for the exam can be done by purchasing a participation certificate at www.vhls.global.

Number of questions:	40
Time (minutes) for the exam:	60 minutes
% minimal passing grade	65%
Open/closed book:	Closed
Language:	Dutch and English. See www.vhls.global for other available languages.
Exam format:	Online
Type of questions:	Multiple choice. Candidates are advised to read the questions carefully.
Are there also negative questions included in the exam?	Yes. Candidates are advised to read the questions carefully.

Levels

The Certified Test Automation Professional (CTAP) Foundation Certification tests candidates at levels 1 and 2, according to the Bloom Revised Taxonomy.

Bloom Level 1: Recall & Retention
We test candidates on their ability to memorize factual information, to retain information by collecting, remembering and recognizing specific knowledge. Knowledge includes facts, terms, answers or terminology.

Bloom Level 2: Understanding
We test candidates on their ability to construct meaning from oral, written or graphical pieces of information. This is done by interpreting, summarizing, distracting, comparing, classifying, predicting or explaining the message.

Learning objectives

The learning objectives state what the delegate will need to know and be able to execute after successfully obtaining this certification. The certificate that the student will receive proves that they have learned:

- An understanding of test automation.
- Why test automation is important for current development methods.
- What are the purposes of test automation.
- The advantages and disadvantages of test automation.
- In which cases are test automation applicable.
- Which trends are recognized inside test automation.
- Different kinds of test tools.
- Selection of test tools.
- The evolution of test automation.
- Manual vs automated testing.
- Scripting.
- Implementation of test tooling.
- Future-proof development of test automation.
- Introduction to scripting.
- Testing automation and development methods.
- Testing automation functions.
- A CTAP certified person is able to implement test automation inside an Agile release train and to transfer knowledge inside and outside the release train.

Exam requirements and specifications

Module	Exam Requirements	Exam Specification	Weight %	Ref.
1	Introduction		10%	
1.1		The importance of test automation for current development methods		A, D
1.2		The purposes of test automation		D
1.3		Advantages and disadvantages of test automation		D
1.4		A CTAP certified person is able to implement test automation inside an Agile release train and to transfer knowledge inside and outside the release train		B, D
2	Test automation		30%	
2.1		The cases in which test automation is applicable		D, H
2.2		Which trends are recognized inside test automation		D
3	Tooling & Scripting		35%	
3.1		Different kinds of test tools		D
3.2		Selection of test tools		D
3.3		Introduction to scripting		D
3.4		Implementation of test tooling		D
3.5		Scripting		D
4	Establishment of test automation		10%	
4.1		The evolution of test automation		A
5	Architecture		15%	
5.1		Manual vs automated testing		A
5.2		Future-proof development of test automation		A
5.3		Test automation and development methods		A
5.4		Test automation functions		A

Key terms and concepts

The following terms are relevant to the CTAP certification

Definition	Description
Agile	Agile simply means continuous incremental improvement through small and frequent releases and collaboration.
Architecture	A description of a system from different perspectives for the purpose of guiding the design and evolution of the system.
Architecture principle	Statement that expresses a belief and gives direction to the design of one or more systems.
Record & playback tool	A tool that takes input during manual test execution to generate test scripts that can later be automatically executed.
Data generation	The process of defining the test data for an application to be tested.
Data-driven testing	A form of testing in which test cases use test data (input and output) defined in a separate file.
DevOps	Integrating software development and operations so that responsibility for the entire lifecycle falls under the responsibility of one team.
Driver	A software component that calls and/or controls other software components.
Dynamic test	A test in which the program code of the system under test is executed.
Feature	The product's service/function that provides business value and meets customer needs.
Functional test	A test based on the functional requirements.
Event driven testing	A form of testing in which test cases are defined (recorded) in terms of the events that occur when using the system under test.
Behavior driven testing	A form of testing in which test cases are expressed in a pseudo language in terms of Given-When-Then, that is close to natural language.
Reusability	The reuse of developed automated components in other test levels or test formats.
Repeatability	The repeated execution of automated tests without significant adjustments.
Keyword driven testing	Testing based on test cases expressed in keywords, where the keywords are expressed in actions to be performed.

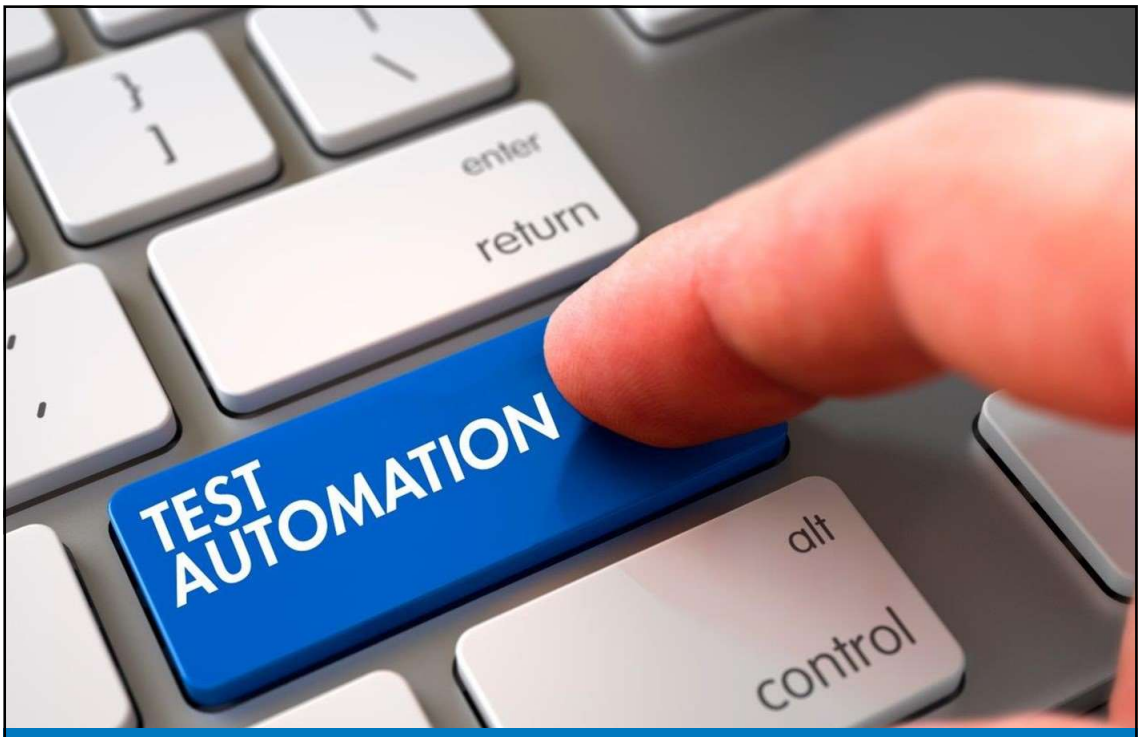
Model driven testing	A form of testing in which the test cases are expressed in structured models that can be interpreted automatically.
Non-functional test	A test based on the quality requirements with regard to non-functional requirements such as Performance testing.
DTAP	Development- Test- Acceptance- Production- environments.
Transferability	Transferring automated tests to users other than the original test engineer or other technology.
Perspective	A way of looking at reality.
Production data	Data as present in the production environment.
Regression test	Testing a previously tested software component after a change to determine that no bugs have been introduced or disclosed in unmodified areas of the software component as a result of those changes.
Stub	A minimal implementation of a software component, used to develop or test a component that calls or otherwise depends on that software component.
Synthetic test data	Data generated specifically for testing purposes.
Static test	A review or inspection of documentation or program code
Test analyst	The person who defines tests on a functional level.
Test architect	The person who draws up the contours of the test project.
Test automation	Using software to perform or support testing activities.
Test automation framework	A set of software components that can be used in programming automated tests, including agreements on their use.
Testing policy	Laying down the most important principles about how testing and test automation are handled. Indicating how test automation is organized in an organizational way.
Test consultant	The person who advises the project and line organization on test vision and policy.
Test data	Data that is needed for a test to work or that arises during the execution of a test.
Test data engineer	The person who ensures that the required test data is made available in any way that complies with regular laws and regulations.
Test data management	Ensuring that good test data is available to support the testing process

Test data strategy	The approach and elaboration of how an organization deals with the use of test data, the development and management of the use of test data.
Test engineer	The person who defines tests on a technical level.
Test management	Planning, budgeting, monitoring and controlling test activities.
Test run	The execution of one or more test cases on the system to be tested.
Test level	A group of testing activities that are jointly organized and managed. A test level is linked to the responsibilities in a project such as unit test, system test, functional acceptance test, e2e test, user acceptance test and production acceptance test.
Test suite	A collection of test cases that belong together.
Test tool	A computer program that supports one or more test activities such as planning and management, specifying, building initial files and data, running the test, and test analysis.
Test performer	The person who performs the defined tests.
Test vision	Describing the objectives of test automation within an organization.
Test type	A collection of test activities with the objective of testing a component or application on one or more related quality attributes such as a functional test, a performance test or a security test.
Test ware	Those products that are made to carry out the test process, such as a test plan, test cases, test scripts and test data.
Velocity	The speed of a development process, typically expressed in the number of user stories completed and tested per iteration.
Virtualization	Creating an environment to simulate hardware functionality within software is run.

Recommended literature

ID.	Source	Form
[A]	'Testautomatisering wendbaar organiseren' – Rooyen, van J, Mersie, MJ, – 2020	Core literature
D	Geautomatiseerd software testen. Egbert Bouman	Core litrature
H	M. Siteur: "Automate your testing, sleep while you are working, blz 143-144," Academic Service, 2005.	Core literature
B	'Het gebruik van testautomatisering binnen Agile projecten' – Rooyen, van J – 2012	Optional
C	'Acht redenen om te beginnen met unit tests' – https://www.delta-n.nl	Optional
E	D. Greefhorst, M. Mersie, J. van Rooyen: "Principes van testautomatisering," Computable, 2015.	Optional
F	J. van Rooyen: "Effort estimation test automation in an Agile environment," Valid2016, 2016.	Optional
G	C. Schotanus et al.: "Testframe, hoofdstuk 6,7,8," Academic Service, 2008.	Optional
I	J. van Rooyen: "Het gebruik van testautomatisering binnen Agile projecten", 2012.	Optional
J	Ravichandran et al.: "DevOps for Digital Leaders" CA Press, 2016	Optional

SLIDE DECK



 1

Program

- **Day 1**
- Test tool overview
- Working with:
  - Graphical user interface
  - Programming interface
- Test tool selection
  - Tool adoption
  - Tool selection
- Working with:
  - Graphical user interface
  - Robot Framework

Program

Day 2

- Test roles
- Continuous testing
- Working with:
  - Robot Framework
  - Cypress
  - BrowserStack

 2

Program

Day 2

- Test roles
- Continuous testing
- Working with:
  - Robot Framework
  - Cypress
  - BrowserStack

 3

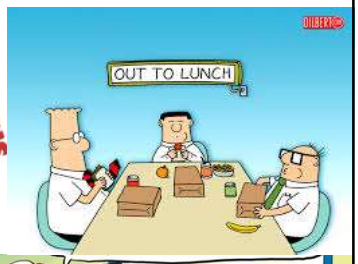
The group

- Be open
- Be critical
- Be involved

 4

Announcements

- Time
- Breaks/lunch
- Disruptions: mobile phones
- Questions asked?
- Materials



 5

Materials

- Courseware
- Exercises
- Tools:
  - Selenium IDE plug-in
  - Postman
  - Robot Framework
    - Python
  - Cypress
    - Nodejs
  - Visual Studio Code

 6

Introduction – let's get acquainted

- Which tools do you use?
- Nothing yet?
  Choose the tool that best fits your wishes
- There are tools available for every budget
- It is important to determine in advance what you are going to test

Test tool overview

In the last couple of years the number of test tools has increased enormously

 9

What is test automation?

Test automation is that part of the test where you can use tools

Differences between test automation and automated testing

- *Automated testing (test execution)*:
  - By this we mean the automated execution of test cases, test scripts and results assessment
    - It has been recognized this can done be better by computers than by hand
- *Test automation (in general)*:
  - Test automation not only includes *test execution*, but also the automated support of all different proccesses within testing, such as:
    - Test design / Test analysis
    - Test management tools
      - saving test cases
      - registering and *monitoring* findings
    - Test environment, test data tools

 11

 10

Differences between test automation and automated testing

- *Automated testing (test execution)*:
  - By this we mean the automated execution of test cases, test scripts and results assessment
    - It has been recognized this can done be better by computers than by hand
- *Test automation (in general)*:
  - Test automation not only includes *test execution*, but also the automated support of all different proccesses within testing, such as:
    - Test design / Test analysis
    - Test management tools
      - saving test cases
      - registering and *monitoring* findings
    - Test environment, test data tools

 11

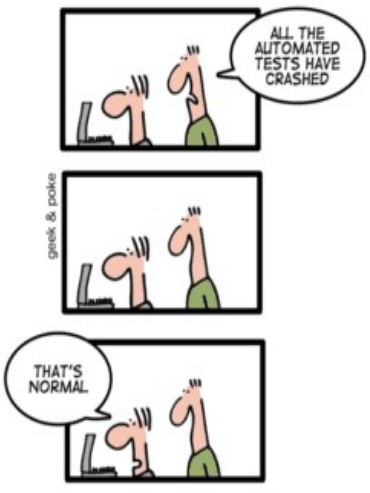
Examples of test automation: test mgt tools

 12

Examples of test automation: test execution tools

 13

Why automated testing?



- Reasons:
  - *I don't want to do the same thing over and over*
  - *I want testing to run while I am asleep*
  - *I want regression testing*
  - *I want performance testing*
  - *Because it's fun!*

 14

Why automated testing?

- When testing, repeatedly performing the same tests and checks plays an essential role
- For example: when re-testing to assess whether a finding has been resolved, or when performing regression tests

 15

Automated testing becomes more important

- Due to the increasing need for shorter time-to-market
- By applying the Agile/Scrum method (incremental development of products)
- Through *DevOps* (Continuous Integration and Continuous Delivery)

 16

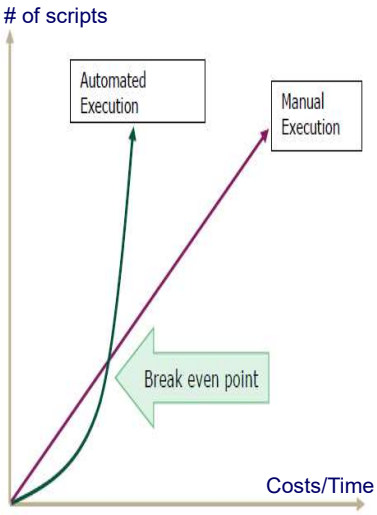
Goals of automated testing

- Increasing and rebuilding the functional coverage
- Reducing test costs
- Performing tests that can't be performed manually (security tests, performance tests)
- Shortening the lead time of test execution
- Realizing a faster feedback of test results

 17

Benefits of automated testing

- *Speed: tools are faster than humans*
- *Repeatable: tools can perform exactly the same actions again and again*
- *Re-usable: on different versions of software*
- *Manageable: think of test design, test scripts, assessment management*



 18

Why not start right away?

 19

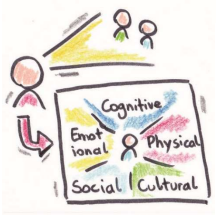
Counter arguments

- Tooling requires the necessary expertise
- License costs
- Not every test script can be used multiple times
- Maintenance of test scripts
- Application is subject to too much change
- Creating a good test environment takes a lot of time and is expensive

 20

Arguments in favor

- Higher reliability by switching off the human factor
- Higher productivity allowing more test to be performed
- More job satisfaction due to automating routine activities

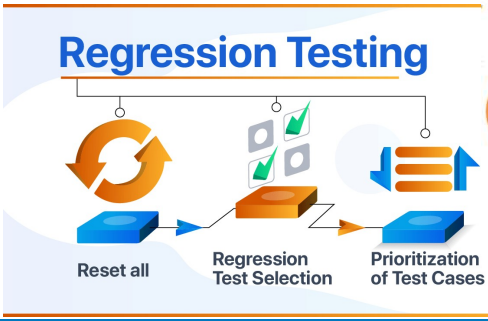


 21

Arguments in favor

More testing options, for example:

performance- security- and *regression testing*



 22

Arguments in favor

- Reducing test time helps to enhance customer service
- Finding errors earlier:
  - Reduces the number of production incidents
  - Helps by reducing error recovery costs
- The use of a tool forces a standard way of working

When can you start?

- The stability of the code
  - Are there not many more changes in the part of the application where you want to automate testing?

  >> Then you are ready to start!

When can you start?

- The maturity of your test organization
  - Do you have a test environment? Do the testers work in a uniform manner?

  >> Then you are ready to start!

When can you start?

- The objective of your organization
  - As an organization, do you want a quicker time-to-market or more releases per year?

  >> Perhaps you are ready to automate testing