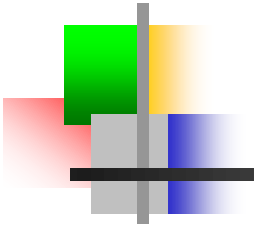
System Test Automation Conference 2013
@Oracle Aoyama Center

Test Automation Past (,Present) and Future

Keizo Tatsumi

2013.12.1

Translated into English in March 2015



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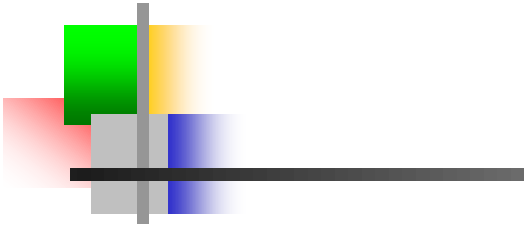
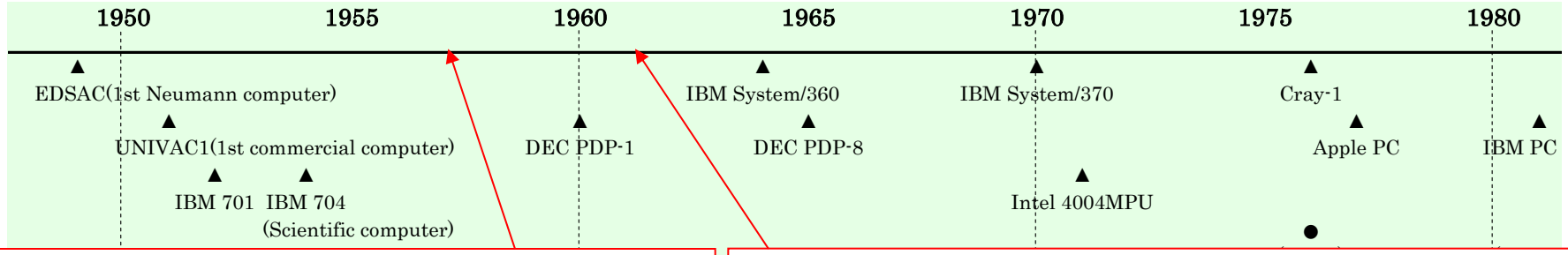


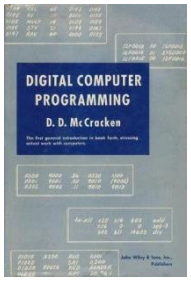
I. Test Automation - Past

1. Beginnings
2. 1970s
3. 1970s-1980s
4. Mid 1980s-1990s

Test Automation - Beginnings -

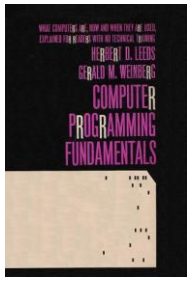
- Early paper on test automation
  - 1962, Automatic Program Testing (G. Renfer, IBM Canada)
    - Program testing packages for standardizing testing procedures and promoting the efficient use of machine time
      - Creation of the input test data on magnetic tapes and/or disks
      - Printing (memory, memory snapshot, tape)
      - Trace (disk file, branch trace)
      - Generation of operating instructions from instruction cards prepared by the programmer





1957, Digital Computer Programming (McRacken)

- The earliest textbook on programming
- Today's debugging and testing are described in the "Program Checkout" chapter

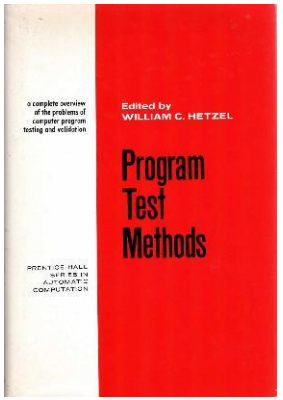


1961, Computer Programming Fundamentals (Leeds & Weinberg)

- Written by Leeds and Weinberg of IBM
- The first book which provided the "Program Testing" chapter

Test Automation - 1970s -

- Software Crisis
  - 1968, 1969, NATO Software Engineering
    - Including "Tools" as a major subject of production process
- Automation efforts on software testing
  - 1972, Program Test Methods
    - First symposium and first book on software testing
    - Papers on test automation
      - Automated Software Quality Assurance (TRW)
      - A Software Testing Control System (IBM)
  - Automated verification system
    - PACE (Product Assurance Confidence Evaluator) [TRW,1972]
    - PET (Program Evaluater and Tester) [McDonnell Douglas,1972]
    - RXVP [General Research,1974]



Test Automation - 1970s -

- First list of testing tools (D. Reifer)
  - 1975, Automated Aids for Reliable Software
  - 1977, A Glossary of Software Tools & Techniques

SPECIAL FEATURE

A Glossary of Software Tools and Techniques

Donald J. Reifer
and
Stephen Trattner
The Aerospace Corporation

Introduction

Software tools can serve as powerful aids in the design, development, test, and maintenance of computer software. So in light of the recent growth in cost of software relative to total system cost, it should come as no surprise that the subject of software tools has sparked a good

timing data on program elements during test case execution for a Cobol program. The reader would turn to Table 1 to determine that he should have a test and evaluation tool associated with the development portion of the software life cycle. He would then look through Table 2 under the "Test and Evaluation" column for promising tools. For each tool that appears to be of some

- Tools in test execution phase
  - Automated Test Generator
    NASA ATDG
  - Automated Verification System
    RXVP, PET, PACE
  - Environment simulator
  - Test Drivers, Scripts, Data Generators
  - Test-Results Processor

Table 2. Life cycle relationships

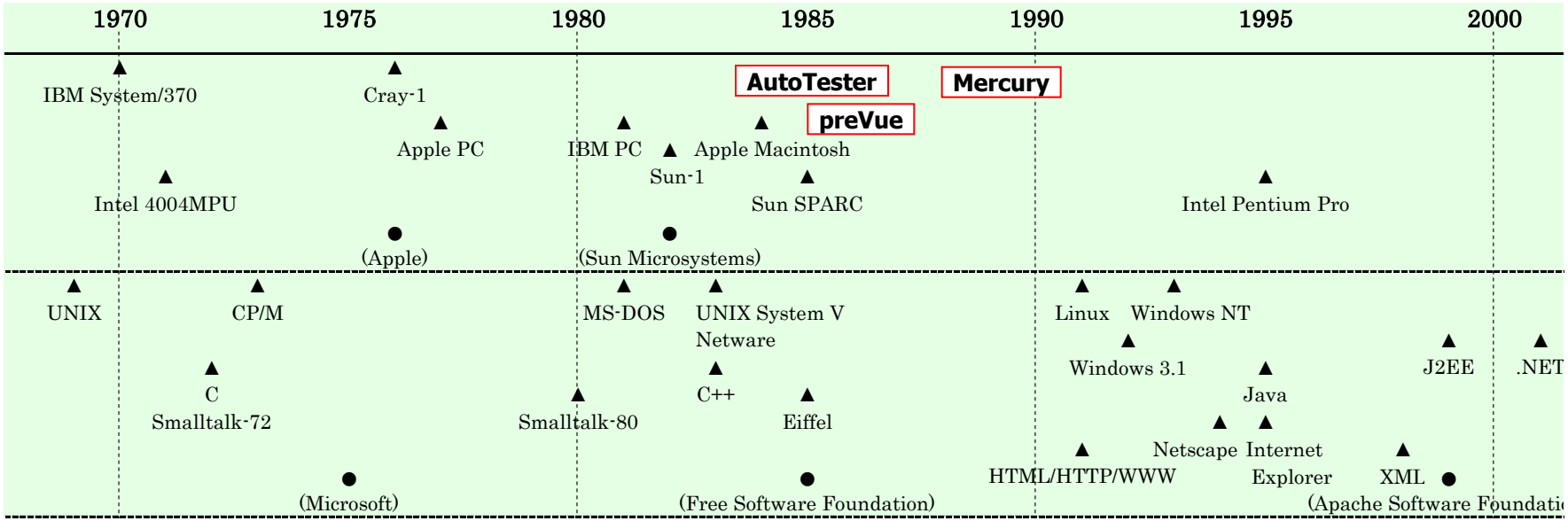
TOOL OR TECHNIQUE	SIMU-LATION	DEVEL-OPMENT	TEST & EVALUA-TION	OPERA-TIONS & MAINTE-NANCE	PERFOR-MANCE MEASURE-MENT	PROGRAM-MING SUPPORT
1. ACCURACY STUDY PROCESSOR			X			
2. ANALYTICAL MODELING	X					
3. ANALYZER		X	X	X	X	
4. AUTOMATED TEST GENERATOR			X	X		
5. AUTOMATED VERIFICATION SYSTEMS			X	X		
6. BOOTSTRAP LOADER						X
7. COMPARATOR			X	X		
8. COMPILER		X	X	X	X	
9. COMPILER BUILDING SYSTEM		X				
10. COMPILER VALIDATION SYSTEM			X			
11. CONSISTENCY CHECKER		X	X			
12. CORRECTNESS PROOFS			X			
13. CROSS-ASSEMBLER		X				
14. CROSS-REFERENCE PROGRAM			X	X		
15. DATA BASE ANALYZER		X	X	X		
16. DATA DESCRIPTION LANGUAGE		X				
17. DECOMPILER			X	X		
18. DESIGN LANGUAGE PROCESSOR		X				
19. DIAGNOSTICS/DEBUG AIDS			X			
20. DRIVER			X			
21. DYNAMIC SIMULATOR	X		X			
22. EDITOR			X	X		
63. TEST DRIVERS, SCRIPTS, DATA GENERATORS			X			
64. TEST-RESULT PROCESSOR			X			
65. TEXT EDITOR						X
66. TIMING ANALYZER	X	X	X	X	X	X
67. TOP-DOWN PROGRAMMING		X				
68. TRACE PROGRAM		X	X			
69. TRANSLATOR		X		X		
70. UTILITIES						X

Test Automation - 1970s-1980s -

- Test tools used by software QA division for mainframes
  (In the case of the department that the author worked in. circa 1990, about 70 tools)
  - Simulators
    - MTS (Multi Terminal Simulator)
    - HTS (Hardware Trouble Simulator)
  - Regression test automation
    - Construction and execution of proper regression test suites
  - Test data, database generation
  - Test result checking
    - Compare with the expected result
    - Check the completion code
  - Test case generation
    - Automatic generation of compiler test suites
    - Test case design support system(ATAF)
  - Stress testing
    - Memory allocation, interruptions
    - System operation command
  - System status display
    - Memory usage, disk space usage
    - Log and trace reporting
  - Utilizing the OS function
    - JCL(Job Control Language) macros
    - I/O trace, Network trace
    - Automatic operation facility
  - Other tools
    - Bug tracking (issue, reply, correction)
    - Media and file format checking

Test Automation - Mid 1980s -

- UNIX, PC, Open system, Internet/Web
  - 1985, AutoTester, Inc. (Randy & Linda Hayes)
    - Development of the first test automation tool for PC, AutoTester
  - 1986, Performance Awareness Corp (acquired by Rational in 1997)
    - preVue (capture-replay, performance analysis, multi-user testing)
  - 1989, Mercury Interactive Corp (acquired by HP in 2006)
    - First product shipment in 1991



Test Automation - 1990s -

- Increasing of commercial test tools
  - 1991, CAST Report (Graham)
    - CAST : Computer Aided Software Testing Tools
    - Test tool lists with their descriptions
  - Mercury Interactive
    - 1991, XRunner
    - 1993, WinRunner, LoadRunner
    - 1996, WebTest
    - 1999, QuickTest
  - 1994, Software Test Technologies Report (Daich)
    - by STSC (Software Technology Support Center, US Air Force)
    - Test tool lists with their descriptions

      421 products from 207 vendors

      (50 products for mainframes or proprietary systems)

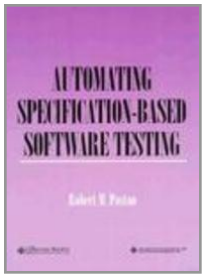
Test Automation - 1990s -

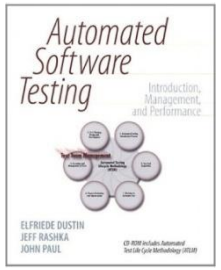
- Number of test tools by classification
  - Software Test Technologies Report (1994)

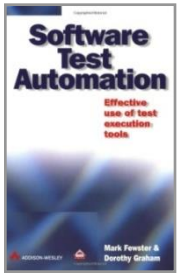
Classification	No. of tools
Auditor	53
Capture-Replay Tool	**58**
Comparator	**22**
Complexity Measurer	76
Coverage/Frequency Analyzer	62
Cross Referencing Tool	93
Defect/Change Tracker	41
Performance/Timing Analyzer	**74**
Requirements-Based Test Case Generator	**9**
Run-Time Error Checker	25
Size Measurer	58
Structure Checker	125
Syntax & Semantics Analyzer	81
Test Execution Manager	**68**

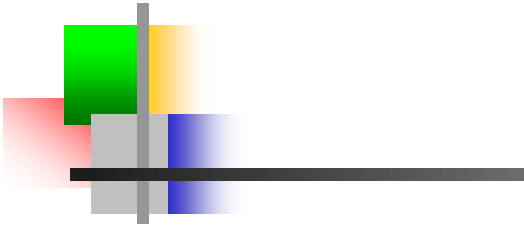
Test Automation - 1990s -

- Test Automation Books
  - 1995, Automated Testing Handbook (L. Hayes)
    - First book on test automation
  - 1996, Automating Specification-Based Software Testing (R. Poston)
  - 1999, Automated Software Testing (E. Dustin et al.)
    - 2002, Japanese translation
  - 1999, Software Test Automation (M. Fewster & D. Graham)
    - 2014, Japanese translation





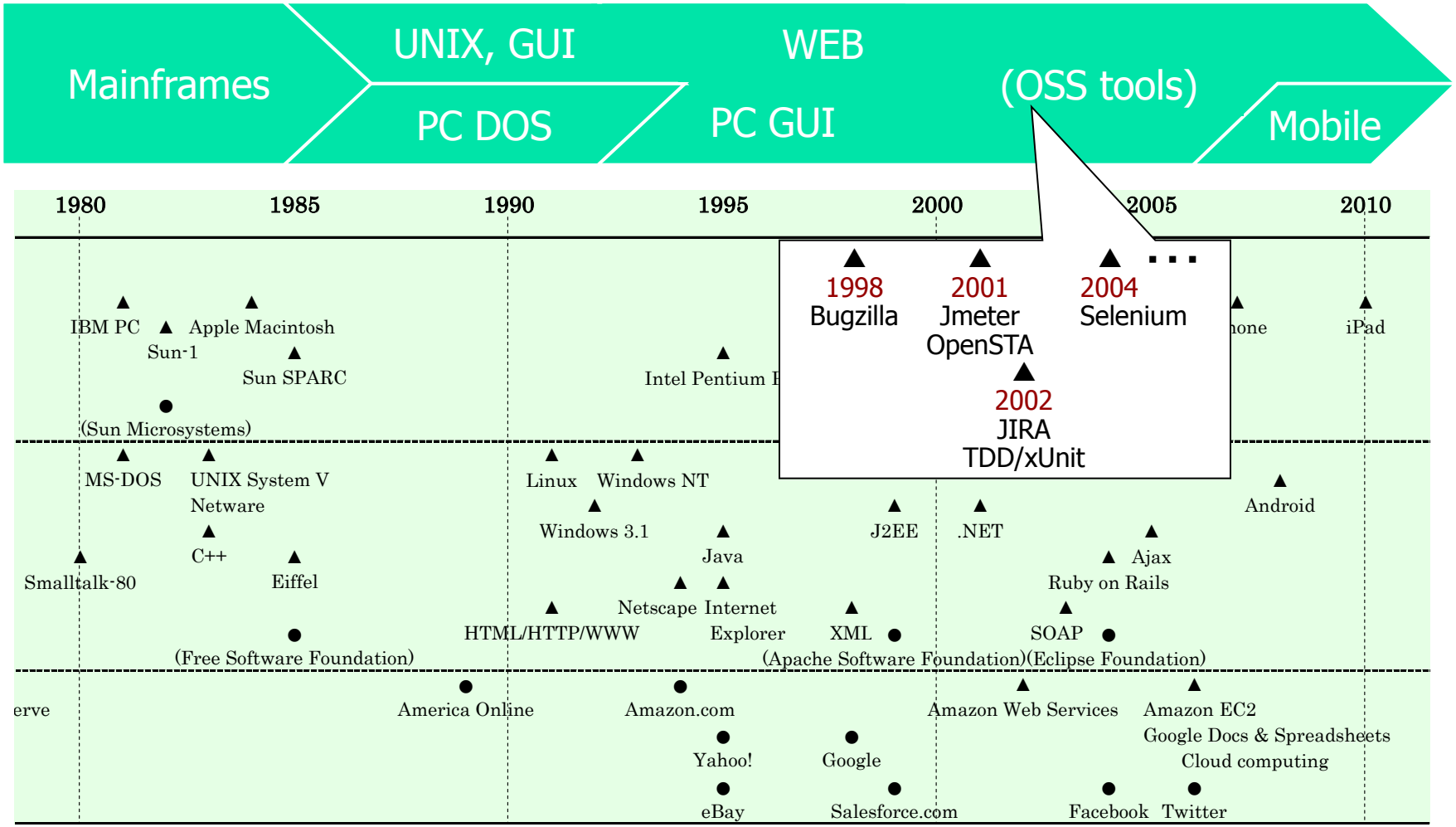




II. Test Automation - (Present)

Looking back the history

- Transitions of the target of test automation tools

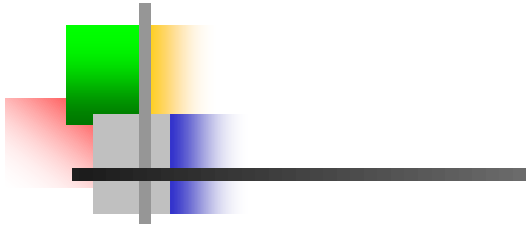


By the way, Why the tool is named "Selenium"?

- Selenium
  - A chemical element with symbol Se and atomic number 34
  - Selenium intakes reduce the effects of mercury toxicity
- Mercury poisoning
  - A type of metal poisoning and a medical condition caused by exposure to mercury or its compounds.
- Jason Huggins (Developer of Selenium)
  - Selenium was so named because Huggins was seeking a name that would position the product as an alternative to Mercury Interactive QuickTest Professional commercial testing software. The name, Selenium, was selected because selenium mineral supplements serve as a cure for mercury poisoning. (*2)

<References>

(*1) http://en.wikipedia.org/wiki/Selenium_(software)
(*2) http://news.techworld.com/applications/3272444/open-source-selenium-web-app-test-suite-to-support-iphone-and-android/



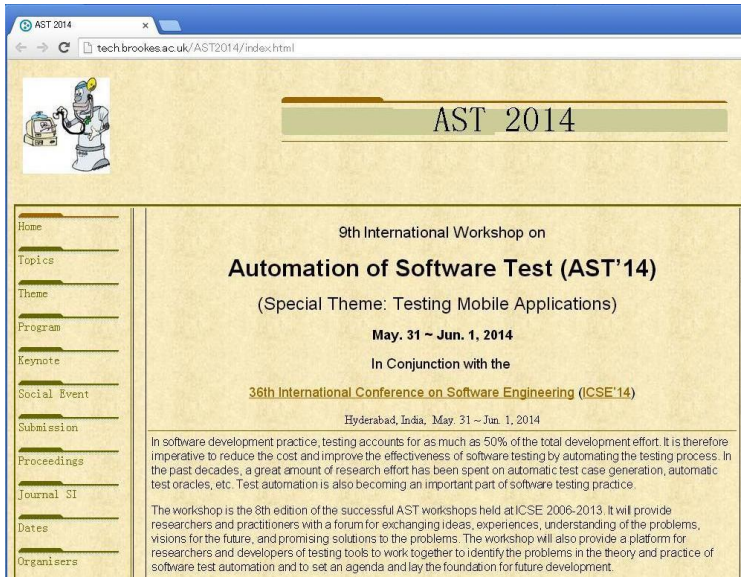
III. Test Automation - Future

1. Research Themes

2. Test Automator

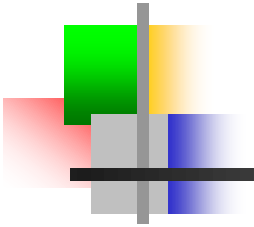
Research Themes

- AST (International Workshop on Automation of Software Test)
  - Held in conjunction with ICSE
  - 1st. AST held in 2006
  - 2 days since 2009



- STA (International Workshop on Software Test Automation)
  - Held in conjunction with COMPSAC
  - 1st. STA held in 2009

ICSE : International Conference on Software Engineering
COMPSAC : International Computer Software & Applications Conference



Research Themes (AST)

- Themes & Topics (from CfP)
  - Methodology
  - Technology
  - Tools and environments
  - Experiments, empirical studies and experience reports
  - Identification of problems and visions of the future

Research Themes (AST)

- Special theme of AST workshop
  - 2008, Model-Based Testing for Test Automation
  - 2009, Testing Web Services
  - 2010, Integration Testing
  - 2011, Relating Software Design to Test Automation
  - 2012, Automation of Security Test
  - 2013, Testing Software as a Service (*1)
  - 2014, Testing Mobile Applications

(*1) Testing as a Service (TaaS)

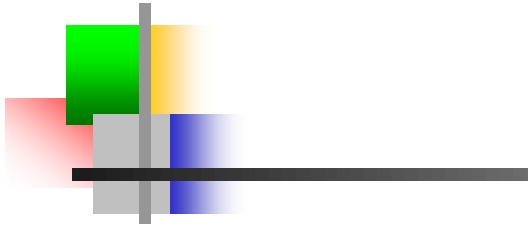
- New business and service models via Cloud cf. SaaS, IaaS, PaaS

Cloud Testing, TaaS

- Cloud Testing
  - Testing and measurement activities on a cloud-based environment and infrastructure by leveraging cloud technologies and solutions. [Gao]
    - Testing a SaaS in a cloud
    - Tesing of a cloud
    - Testing inside a cloud
    - Testing over clouds
- TaaS (Testing as a Service) [Gao]
  - Initially introduced as a concept by Tieto in Denmark in 2009.
  - providing static/dynamic on-demand testing services in/on/over clouds for the third-parties at any time and all time.
  - Service providers
    - SOASTA http://www.soasta.com/
    - ITKO (acquired by CA in 2011) http://www.itko.com/solutions/cloud.jsp
    - IBM – Cloud Application Management – Cloud Testing Services
    - HP Application Lifecycle Management (ALM) on SaaS

<References>

Jerry Gao et al., "Cloud-Testing - Issues, Challenges, Needs and Practice," 2011 http://seij.dce.edu/Paper%201.pdf
Sergiy Vilkomir, "Cloud Testing: A State-of-the-Art Review," 2012 http://www.it4sec.org/node/3146

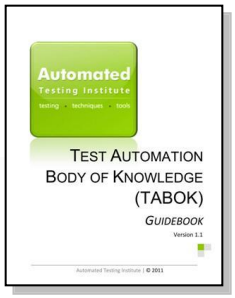


III. Test Automation - Future

1. Research Themes

2. Test Automator

Test Automator



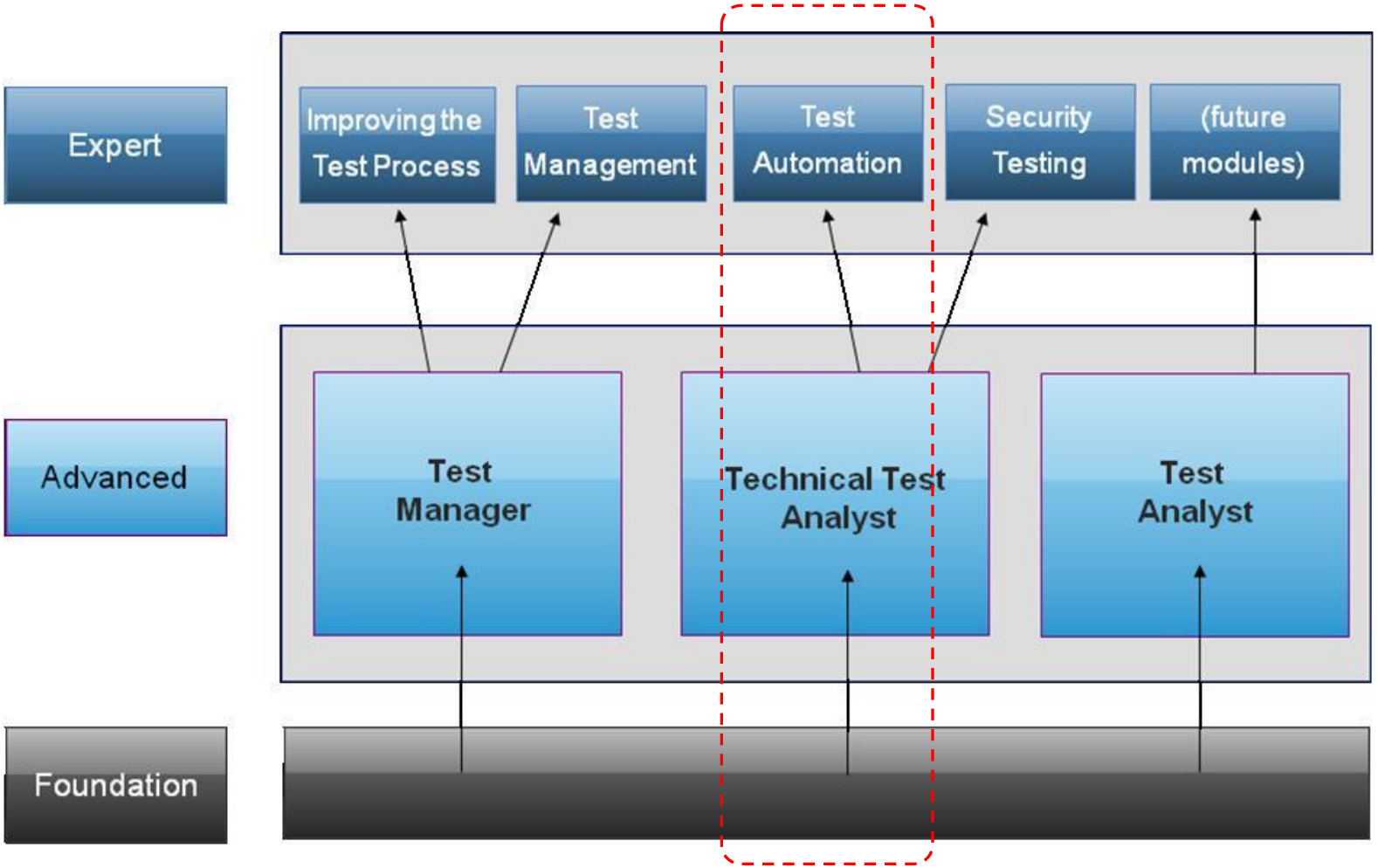
❑ Automated test roles in the TABOK

Role	Description
Test Lead	· Responsibilities mainly involve administrative tasks · Creating an Automation Implementation Plan · Allocating automation personnel to appropriate tasks
Test Engineer	· normally not directly involved with automation tasks but is rather responsible for the manual testing tasks · works with the Automation Engineer to decide what should be automated and how manual procedures may be modified to better facilitate automation
Lead Automation Architect	· is responsible for framework maintenance, configuration management activities relative to the framework · typically held by a test tool subject matter expert as well as an automation framework subject matter expert
Cross Coverage Coordinator	· is responsible for ensuring all automation efforts that utilize a single framework are in sync with one another · to idetify maintenance procedures including the proper use of versioning software and suggested use of reusable components · to suggest necessary framework changes and automation techniques
Automation Engineer (**Test Automator**)	· is responsible for the application specific automation tasks · the primary concern is the automation of assigned application functionality or tasks within the framework

Test Automator

- ISTQB certification path

Certified Tester Advanced Level Overview, Version 2012, ISTQB

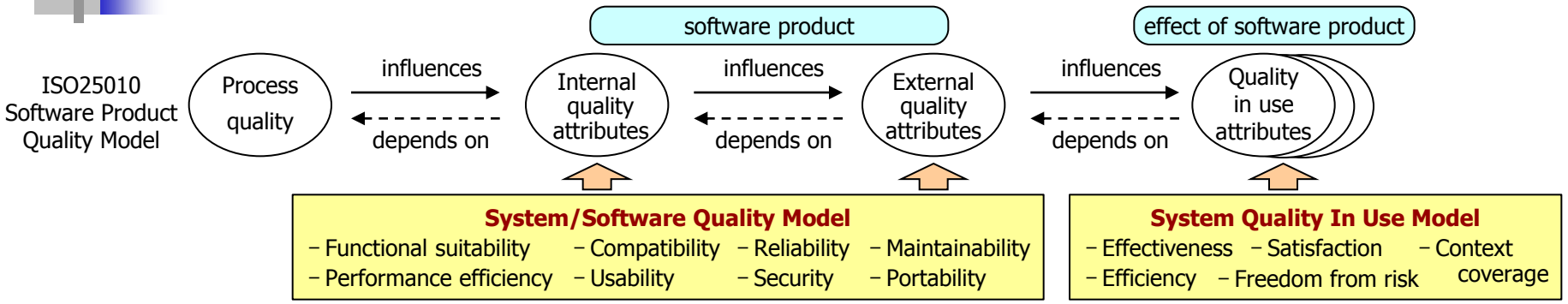


Job description of Test Automator

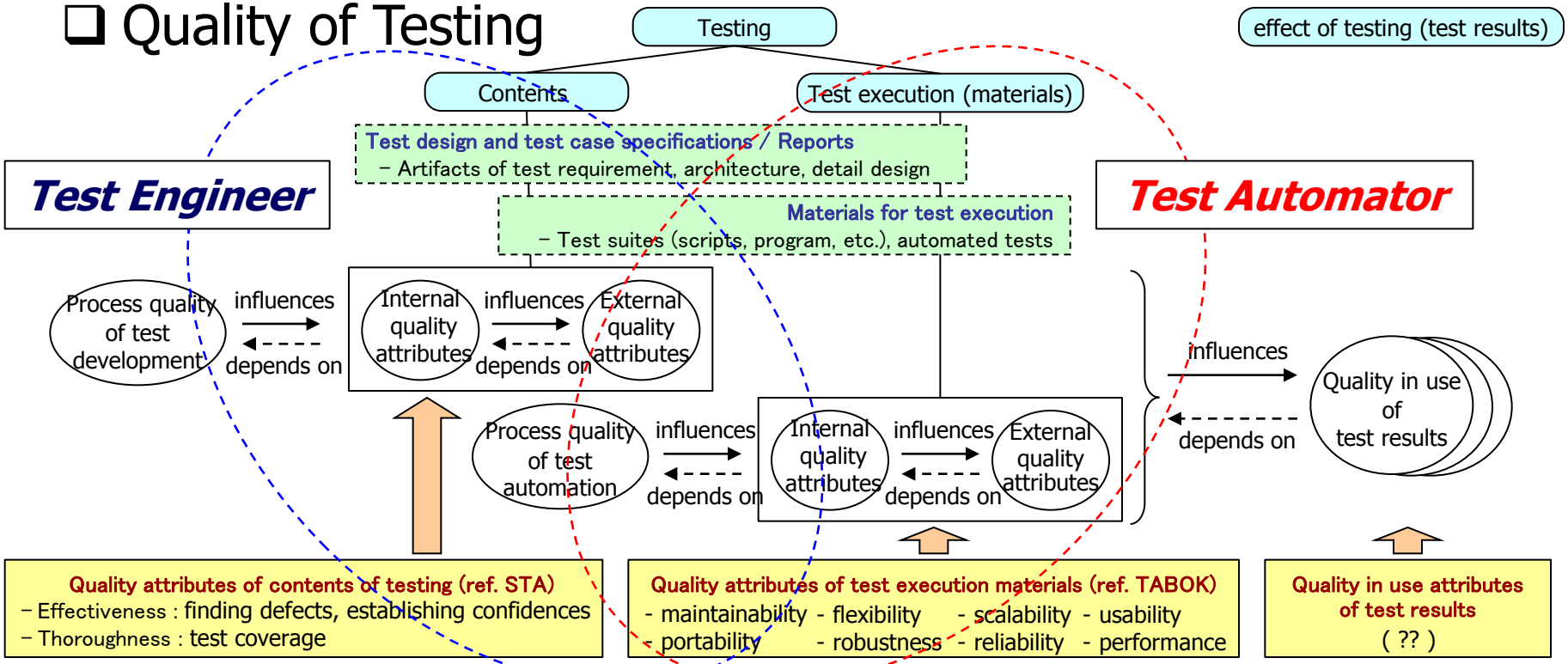
- Job offer (Capgemini)
  - Job Functions & duties
    - Participates actively in the Test Plan and Test Strategy preparation
    - Maintains and obtains approval for the Test Automation plan
    - Creates/supports metrics/status reporting to the Test Manager
    - Provides test automation expertise to the various projects
    - Provides the overall automated testing solution
    - Evaluates new technologies and tools available
    - Provides end to end automated tests to clients
    - Prepares automated tests
    - Defines levels and timing for automation
    - Integrates manual and automated test execution effort

    etc.
  - Experience
    - At least 3 years of experience in test analysis
  - Knowledge
    - Defect Management
    - Test Management, Test techniques
    - Knowledge and understanding of development methodologies
    - Expert knowledge of Test Tools

Responsibilities of Test Automator



❑ Quality of Testing



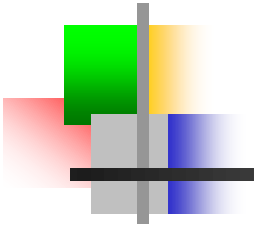
How many Test Automators?

- LinkedIn member search (as of November 20, 2013)
  - Software Engineer : 3,531,260 people

Search Keywords	Hits(=people)		
Software Engineer	3,531,260	-	"Software Engineer“ hit 1,666,591
Software Engineer "Test Engineer"	149,267	4.2%	
Software Engineer "Software Tester"	18,857	0.5%	“Software Tester” hit 51,722
Software Engineer Tester	86,896	2.5%	
Software Engineer "Test Manager"	21,365	0.6%	
Software Engineer "Test Analyst"	16,843	0.5%	“Test Analyst” hit 62,915
Software Engineer "Technical Test Analyst"	509	0.0%	"Technical Test Analyst“ hit 1,218
Software Engineer "Test Consultant"	4,023	0.1%	
Software Engineer "Test Designer"	838	0.0%	
Software Engineer **"Test Automator"**	58	0.0%	"Test Automator“ hit 119
Software Engineer **"test automation"**	135,662	3.8%	"test automation“ hit 220,089
Software Engineer "Test Engineer" **"test automation"**	41,019	1.2%	

You can become a pioneer of test automator even from now!!

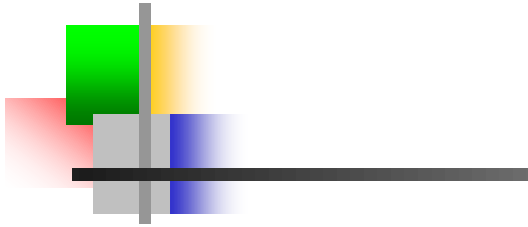
Conclusion



Conclusion

- Although test automation has its long history, its profession started from only 10 to 15 years ago.
- Test automation is a must-have skill for testers. Aside from that, testers can get some idea of "software development" through making full use of tools or being involved with tool development. It can be a great experience.
- In addition to using tools, why don't you summarize and formalize test automation know-how as a methodology or develop a new tool. And challenge yourself to make a debut on stage of the software testing community.

  --> You can share and discuss your idea in the community, such as the Software Testing Automation Research Group.jp.



Thank You !